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# LANDBOUNAVORSING AGRICULTURAL RESEARCH

1986

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Department of Agriculture and Water Supply



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LANDBOU EN WATERSKAP  
AGRICULTURAL RESEARCH

1986



Department of Agriculture and Water Supply  
Departement van Landbou en Watervoorsiening



**BEPLANNING EN KOÖRDINASIE VAN  
LANDBOUNAVORSING EN  
LANDBOUVELDDIENSTE**

**Departement Landbou en Water-  
voorsiening\***

**HOOF**

AGENBACH, D.J., B.Sc.(Agric.)(Stell.),  
B.Inst.Agrar.(Hons.)(Pret.), D.Inst.Agrar.(Pret.)

**HOOFDIREKTEURE**

Koördinasie: HEYNS, A.J., M.Sc.(Stell.),  
D.Phill.(London)

Akkerbou: GROBBELAAR, W.P.,  
M.Sc.(Agric.)(Pret.), D.Agric.(Wag.)

Boerdery-ontwikkeling: BRUWER, J.J., Pr.Ing.,  
B.Sc.(Agric.)(Ing.)(Pret.), M.S.A.E. (Nebraska)

Diereproduksie: VAN DER MERWE, F.J.,  
B.Sc.(Agric.)(Stell.), M.Sc.(Agric.), D.Sc.(Agric.)  
(Stell.)

Tuinbou: BREDELL, G.S., M.Sc.(Agric.)(Pret.),  
Ph.D.(Grondkunde)(Calif.)

**LANDBOUBESTUURADVISEURS**

Akkerbou: Vakant

Boerderyontwikkeling: AUCAMP, A.J.,  
M.Sc.(Agric.)(OVS), D.Sc.(Agric.)(Pret.)

Boerderyontwikkeling: OOSTHUIZEN, G.W.,  
B.Sc.(Agric.)(Stell.), M.Sc.(Agric.)(Pret.)

Boerderyontwikkeling: LE ROUX, L.M.,  
B.Sc.(Agric.)(Pret.), B.Inst.Agrar.(Hons.)(Pret.),  
M.Sc.(Pret.)

Boerderyontwikkeling: SCOTNEY, D.M.,  
B.Sc.(Agric.)(Natal), Ph.D.(Agric.)(Natal)

Boerderyontwikkeling: GROSSMAN, D.,  
M.Sc.(Pret.)

Diereproduksie: HOFMEYER, H.S.,  
M.Sc.(Agric.)(Pret.), D.Sc.(Agric.)(Pret.)

Diereproduksie: SWART, J.A.,  
M.Sc.(Agric.)(Stell.), M.Sc.(Agric.)(Univ. Toronto)

Tuinbou: DU TOIT, J.J., M.Sc.(Agric.)(Stell.),  
D.Sc.(Agric.)(Pret.)

**PLANNING AND CO-ORDINATION OF  
AGRICULTURAL RESEARCH AND  
AGRICULTURAL FIELD SERVICES**

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Water Supply\***

**HEAD**

AGENBACH, D.J., B.Sc.(Agric.)(Stell.),  
B.Inst.Agrar.(Hons.)(Pret.), D.Inst.Agrar.(Pret.)

**CHIEF DIRECTORS**

Co-ordination: HEYNS, A.J., M.Sc.(Stell.),  
D.Phill.(London)

Agronomy: GROBBELAAR, W.P.,  
M.Sc.(Agric.)(Pret.), D.Agric.(Wag.)

Animal production: VAN DER MERWE, F.J.,  
B.Sc.(Agric.)(Stell.), M.Sc.(Agric.),  
D.Sc.(Agric.)(Stell.)

Farming development: BRUWER, J.J., Pr.Ing.,  
B.Sc.(Agric.)(Eng.)(Pret.), M.S.A.E. (Nebraska)

Horticulture: BREDELL, G.S., M.Sc.(Agric.)(Pret.),  
Ph.D.(Soil Science)(Calif.)

**AGRICULTURAL MANAGEMENT ADVISORS**

Agronomy: Vacant

Animal production: HOFMEYER, H.S.,  
M.Sc.(Agric.)(Pret.), D.Sc.(Agric.)(Pret.)

Animal production: SWART, J.A.,  
M.Sc.(Agric.)(Stell.), M.Sc.(Agric.)(Univ. Toronto)

Farming development: AUCAMP, A.J.,  
M.Sc.(Agric.)(OVS), D.Sc.(Agric.)(Pret.)

Farming development: OOSTHUIZEN, G.W.,  
B.Sc.(Agric.)(Stell.), M.Sc.(Agric.)(Pret.)

Farming development: LE ROUX, L.M.,  
B.Sc.(Agric.)(Pret.), B.Inst.Agrar.(Hons.)(Pret.),  
M.Sc.(Pret.)

Farming development: SCOTNEY, D.M.,  
B.Sc.(Agric.)(Natal), Ph.D.(Agric.)(Natal)

Farming development: GROSSMAN, D., M.Sc.(Pret.)

Horticulture: DU TOIT, J.J., M.Sc.(Agric.)(Stell.),  
D.Sc.(Agric.)(Pret.)

\*Privaatsak X116, Pretoria 0001

\*Private Bag X116, Pretoria 0001



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- Directorate of Agricultural Engineering,  
Private Bag X515, Silverton 0127
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Direktoraat Landbou-ingenieurswese  
Privaatsak X515, Silverton 0127

Direktoraat Landbou-inligting,  
Privaatsak X144, Pretoria 0001

Direktoraat Landbouproduksie-ekonomie,  
Privaatsak X416, Pretoria 0001

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Directorate of Agricultural Production Economics,  
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|    |   |                                 |                                    |
|----|---|---------------------------------|------------------------------------|
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| GG | : | Graangewasse                    | Grain Crops                        |
| GS | : | Groente en Sierplante*          | Vegetable and Ornamental Plants*   |
| OP | : | Veeartsenykunde (Onderstepoort) | Veterinary Science (Onderstepoort) |
| PB | : | Plantbeskerming                 | Plant Protection                   |
| PL | : | Plantkunde                      | Botany                             |
| SS | : | Sitrus en Subtropiese Vrugte    | Citrus and Subtropical Fruit       |
| TK | : | Tabak en Katoen                 | Tobacco and Cotton                 |
| VS | : | Vee- en Suiwelkunde             | Animal and Dairy Science           |
| VV | : | Vrugte en Vrughtegnologie       | Fruit and Fruit Technology         |
| WW | : | Wingerdbou en Wynkunde          | Viticulture and Oenology           |

### STREKE/REGIONS

|   |   |                  |                      |
|---|---|------------------|----------------------|
| H | : | Hoëveld          | Highveld             |
| K | : | Karoo            | Karoo                |
| N | : | Natal            | Natal                |
| D | : | Oos-Kaap (Dohne) | Eastern Cape (Dohne) |
| T | : | Transvaal        | Transvaal            |
| V | : | Vrystaat         | Free State           |
| W | : | Winterreën       | Winter Rainfall      |

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\*Opsommings van finale verslae asook lopende fasette verskyn nog onder die kode TB

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\*Summaries of final reports as well as running facets still appear under the code TB



## INHOUD

### LANDBOUNAVORSING

1985.04.01 - 1986.03.31

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1985.04.01 - 1986.03.31

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**FINAL REPORTS ON RESEARCH PROJECTS**  
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## PLANT PRODUCTION PROMOTION

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## **PLANT PRODUCTION PROMOTION**

### **AGRONOMY RESEARCH**

#### **Protein and oilseeds**

##### **SUNFLOWERS**

###### **UPGRADING**

GG.2132/07/1/4:       STUDIES OF ISOGENIC SUNFLOWER RESTORER LINES AND THEIR  
HYBRIDS. 1983-1984  
S.J. Poggenpoel

The development of fertility restoring inbred lines has been a major facet of sunflower breeding since the production of hybrids became an economic feasibility. The majority of male lines have been lines with the recessive branching character because of the extended pollen shedding period.

The objectives of this study were to determine whether the differences between branched (bb) and unbranched (BB) lines were carried over to their respective progenies and to determine the relationships between characteristics of bb male parents, their BB equivalents and their respective hybrids. Isogenic bb and BB restorer lines were developed by continual selection of heterozygotes (Bb) in segregating progenies up to the S5 generation at which stage 15 pairs of "isolines" were crossed to three female lines, HA60, HA99 and H55-9-2-1-1.

The resultant hybrids and all the parent lines were planted in a trial in the 1983/84 season and 16 different quantitative characters were measured. The Gardner and Eberhart (1966) model was used to analyse the data. The major ways in which bb lines differed from BB were: head diameter 0,43 m smaller, total pollen shedding period 5 to 6 days longer and 2 to 3 days quicker in reaching physiological maturity. Furthermore bb lines had a 1 000-seed mass 12,4 g lighter, an oil content 3,7 % higher, protein content 0,8 % lower than their BB counterparts and there were also definite differences in head type, stem bending and head attachment. On the practical level not one of these differences within pairs of isolines caused differences between their respective hybrids. As several of these characters are important selection criteria it is recommended that for at least the first two generations of inbreeding single-headed plants (BB and Bb) be selected within segregating populations by a head to row method. Only after this stage should selection of bb plants be considered. Admittedly this selection method is more time and labour consuming, but the improved response to selection should compensate.

#### **Other agronomic crops**

##### **TOBACCO**

###### **TECHNOLOGY**

TK.2142/52/1/1:       PACKAGING METHODS FOR BULK-HANDLING AND CURING OF  
FLUE-CURED TOBACCO. 1976-1982  
J.G. Nel

Historically, flue-cured tobacco leaves have been aligned at the time of harvest and maintained in an aligned configuration throughout all operations between harvesting and midrib removal. Although the development of bulk curing and mechanical harvesting in the U.S.A. occurred approximately at the same time, bulk curing was adapted six to ten years before mechanical harvesting. This situation fostered the development of a bulk curing rack which was better suited to aligned hand-primed tobacco than to random machine-primed tobacco.

As a result of the availability of labour for hand priming in South Africa and the relatively high clay

content of the soil or the undulating topography of tobacco fields, it is doubtful whether heavy mechanical harvesting devices will ever become a common feature.

The limitations of the curing rack led to the development of larger curing containers or modules, holding approximately 300 to 1 000 kg of uncured tobacco. To overcome the shortcomings of the curing rack, the possibility of introducing larger curing containers, adapted to South African conditions, was investigated. The curing rack, used as the control treatment, was filled with 50 kg uncured aligned leaves with the butt-ends upwards. This was compared with the curing basket which had a capacity of 150 kg uncured leaves aligned with the butt-ends facing upwards, downwards and randomly orientated. The curing basket and small module, of the same capacity, were one-tier containers used in a horizontal curing position. The large curing module (or box) with a capacity of 500 kg was filled with aligned leaves in the bottom tier and with the butt-ends facing downwards while the rest of the module was filled in a plurality of layers and with the butt-ends randomly orientated. In all the modules tines or rods were used to suspend the leaves in a manner so as not to disrupt the airflow during curing. The tops and bottoms of the containers are at least partially open to permit the flow of air.

Grading, price and analytical data show that neither the module, nor the orientation of the butt-ends of the leaf had any significant effect on the quality of the cured tobacco. The modules can furthermore, be more efficiently adapted to labour and time saving mechanised systems of bulk-handling and curing of flue-cured tobacco. The curing of cut-strip tobacco in the modules is not feasible owing to marketing difficulties.

## HORTICULTURE RESEARCH

### Tuber crops

#### POTATOES

#### CHEMICAL CONTROL

TB.2411/21/1/1: THE CHEMICAL CONTROL OF CUTWORMS ON POTATOES. 1978-1985  
H. Steenekamp

Cutworm (*Euxoa segetum*) can cause significant damage to potatoes, to both the stems and the tubers which are not deeply penetrated but are unacceptable for marketing. A survey in the third successive year of cutworm damage showed that an average of 6% of tubers harvested over a 5-month period were sorted out because of the cutworm marks.

Two registered insecticides and several bait treatments were applied in a trial on the Transvaal Highveld, but cutworms were absent from the planting and no damage was recorded on control plots. Because of their sporadic appearance it was decided that control measures would only be commenced when the pest was observed in the potatoes. Another insecticide, chlorpyrifos, has subsequently been registered, and these chemicals, together with the possible use of synthetic pyrethroids have reduced the priority of this research because satisfactory control is now being obtained by the commercial growers. A research programme on this pest is thus not needed.

#### POTATOES

#### CROP SCIENCE

TB.2411/30/2/1: THE INFLUENCE OF PLANTING DATE ON POTATO PRODUCTION AT ERMELO. 1978-1983  
B.J. Pieterse and K.P. Prinsloo

The influence of five different planting dates (15 August, 15 September, 15 October, 15 November and 15 December) on the yield and quality was investigated for five potato cultivars (Astrid, Baku, Draga, Kimberley Choice and Sackfiller) grown on the Transvaal Highveld. The investigation extended over three seasons from 1978/79. To get an indication of quality, the chip colour and specific gravity were determined. The cultivar Sackfiller generally gave a significantly higher yield than all the other cultivars, while 15 August gave on average a significantly higher yield than all the other planting dates. The cultivars did, however,



## Summaries

differ significantly in their reaction to planting dates. A significant higher yield was obtained when Draga and Kimberley Choice were planted on 15 August and when Sackfiller was planted either on 15 August or 15 September. There was no significant difference in the yield when Astrid was planted on 15 August, 15 September, 15 October or 15 November and when Baku was planted on 15 August, 15 September or 15 October. Seasons did, however, also have an influence on the yield. A stress index was used to explain the difference between planting dates and between seasons. To determine a stress index, one point was allocated for each week during growth with less than 10 mm precipitation plus one point for each week during growth with mean maximum temperature above 24 °C.

As far as specific gravity and chip colour are concerned, the optimum planting date for Draga is August, for Baku and Astrid, September and for Sackfiller and Kimberley Choice, August to September.

## POTATOES

### CROP SCIENCE

TB.2411/30/2/4: INFLUENCE OF TUBER SIZE AND SPACING ON POTATO PRODUCTION. 1978-1983  
B.J. Pieterse

The influence of seed size (20 g to 40 g, 70 g to 90 g, 120 g to 140 g and 170 g to 190 g) and spacing (10 cm, 20 cm, 30 cm and 40 cm) was investigated. These results lead to the following recommendations:

Although large seed tubers gave higher yields, the small tubers (20 g to 40 g) brought about more effective use of the seed. The reason for this is the fact that small tubers use less seed mass per stem, which means a definite saving on production costs. As small seed is not readily available, these results are a motivation for the use of cut seed pieces. As far as spacing is concerned, the optimum for table production is 30 cm in the row. Total yield may be lower, but the higher number of large tubers obtained at this wider spacing, is a compensating factor. For seed production, 20 cm will be more advantageous because of the large number of medium sized tubers.

## POTATOES

### CROP SCIENCE

TB.2411/30/2/6: THE EFFECT OF PLANTING DATE AND STAGE OF FOLIAGE REMOVAL ON SEED POTATO PRODUCTION AT RIETRIVIER DURING 1980. 1980-1982  
G.S. Cloete

The object of this experiment was the determination of the effect of different planting dates and stages of foliage removal on seed potato production under irrigation. The experiment was designed as a randomised block with three replications, and was conducted on a sandy clay loam, alluvial soil with 75 % of sand. Flood irrigation was applied between planting hills according to evaporation from a class-A pan.

Four planting dates (4 January, 18 January, 2 February and 15 February) were tested in combination with four stages of foliage removal (80, 87, 94 days after planting and no foliage removed).

The effect of planting date on the total yield was compared at a constant stage of foliage removal. When foliage was removed at 80 and 87 days after planting, a significantly higher yield was obtained with a planting date at the beginning of February compared to the beginning of January. The high temperatures after planting during January could have had an adverse effect on tuber initiation and development in comparison with a planting date during the first half of February. When the foliage was removed 80 to 87 days after planting the tubers did not have sufficient time to develop.

If the effect of stage of foliage removal on total yield is compared at a constant planting date, it is concluded that with a planting date at the beginning of January, zero foliage removal resulted in a significantly higher total mass of potatoes than foliage removal at 80 or 87 days after planting.

## Summaries

### POTATOES

#### CROP SCIENCE

TB.2411/30/2/10:

#### THE EFFECT OF PLANTING DATE ON THE PRODUCTION OF SOME POTATO CULTIVARS AT GLEN. 1979-1982

G.S. Cloete

Five potato cultivars (Up-to-Date, BP1, Vanderplank, Buffelspoort, Earliest of All) were planted under controlled-flood irrigation at five planting dates (30 August, 14 September, 28 September, 12 October, 26 October) at Glen to determine the effect of planting date on tuber yield.

The experiment was laid out as a 5 x 5 factorial in a randomised block design with 4 replications on a Hutton Shorrocks soil, 1-2 m deep.

Apart from total yield, tubers were classed according to size (< 30 g, 31-100 g, 101-150 g, 151-200 g, > 200 g). Quality was measured in terms of specific gravity (S.G.) and chip colour (dry). Statistical analyses were carried out on the results (mass and number of tubers) of each year as well as on the average results of the three years over which the experiment extended. Treatment means were compared according to Tukey's test ( $P = 0,05$ ).

The highest table potato yields were obtained from the cultivars Up-to-Date and BP1, with Buffelspoort as runner-up at planting dates ranging from 30 August to 14 September. Yields declined drastically at planting dates later than 14 September, probably as a result of rapidly rising soil and air temperatures which do not favour tuber initiation and tuber growth. Although the cultivars Vanderplank and Earliest of All were significantly outyielded by Up-to-Date, BP1 and Buffelspoort at all planting dates, their dry chip colour values were not only significantly higher than those of the formerly mentioned cultivar, but also the only acceptable values (50 and above) according to tests carried out by the Horticultural Research Institute, Roodeplaat. With the exception of BP1, the S.G. values of all cultivars were less than the required 1,0700.

Although Up-to-Date and BP1 proved to be the highest yielding cultivars in this experiment, certain specific tuber defects and diseases were observed in these cultivars. BP1 is susceptible to scab (*Streptomyces scabies*) which is aggravated on soils known to be infected. Up-to-Date, on the other hand, is susceptible to soft rot (*Pythium* spp.) especially when harvesting is postponed too long during hot periods in January/February. In addition, malformation occurred in the larger tubers which makes the product less attractive for marketing.

### Vegetables

#### TOMATOES

#### CROP SCIENCE

TB.2421/30/2/2:

#### MANIPULATION OF TOMATOES. 1975-1982

E. Aucamp

During the period 1974 to 1981 trials have been carried out at Roodeplaat, Nelspruit and Addo in an attempt to manipulate the production of tomatoes. The work has centred around two broad categories: firstly, alternative plant support systems which are cheaper and less labour intensive than trellising and secondly, various methods to promote earlier and more concentrated ripening.

Trellising to single poles and parallel wire stands were compared to mechanically constructed ridges, either bare, covered with grass or covered with plastic. The most important findings were that comparable yields, a seven- to ten-days earlier ripening period but more blemished fruit can be obtained with untrelled plants on the ridges. Blemishes were caused by contact with the soil, diseases, wind and sunburn.

Earlier crops were obtained with Ethrel sprays at 1000 ppm applied when the first fruit turned pink and limited positive results with miniature tunnels at the end of winter. Yield increases during the first 14 days of harvest were 10 to 23 % in favour of miniature tunnels.

The soil conditioner polyacryl-amide (PAM) had a very marked positive effect on the percentage and speed of tomato seed germination; 40 % more seed germinated during the first 12 days than in the control treatment. Transplanting of the seedlings delayed the ripening of the fruit with at least a fortnight compared to the seed sown *in situ*.



## SUNDRY VEGETABLES

### PHYSIOLOGY

- TB.2427/03/1/1: SUNDRY VEGETABLES: CHEMICAL WEED CONTROL STUDIES WITH GARLIC. 1981-1985  
P.F. Nortjé

In this experiment herbicides for long-term weed control in garlic (*Allium sativum* L.) were evaluated. Of six herbicides evaluated, only oxyfluorfen gave satisfactory season-long control of weeds present in garlic (*Allium sativum* L.) plantings. Oxadiazon, chloroxuron, nitrofen, methabenzthiazuron, ioxynil and oxyfluorfen showed little or no signs of phytotoxicity on garlic at recommended application rates for onions. Post-emergence applications of oxyfluorfen resulted in severe scorch symptoms which disappeared, however, within 14 days of application. None of the treatments influenced yield, bulb size or stem diameter adversely.

## SUNDRY VEGETABLES

### CROP SCIENCE

- TB.2427/30/1/1: SUNDRY VEGETABLES: CULTIVATION STUDIES WITH GARLIC. 1972-1985  
P.J. Henrico

Planting time and spacing trials with garlic were conducted over three seasons. During 1972 three planting times, and during 1973 four planting times were investigated, namely early March, end of March, mid-April and mid-May. During 1983 garlic was planted each month from December to May.

During 1972 and 1973 three spacings were applied:

1. 400 x 50 mm
2. 400 x 75 mm
3. 400 x 100 mm

The results show that the optimum planting time for garlic in the Transvaal Middleveld to be during the second half of March, although good yields can be expected with mid-February and mid-April planting times. Yield increased drastically from a mid-February planting to the optimum in March, where after a decline in yield occurred.

The best yield was obtained throughout with a spacing of 400 x 50 mm, although bulb size was impaired, compared to the other spacings. During later planting times wider spacing is beneficial to bulb size.

Unlike onions, bulb size of garlic is not dependable on vegetative growth. Very good bulb size was obtained in a February planting during 1983 with relative small top growth.

## Flowers and ornamental plants

### PROTEAS

### TAXONOMY

- TB.2431/01/1/1: IDENTIFICATION AND DESCRIPTION OF PROTEA SPECIES. 1975-1985  
G.J. Brits

This work was initiated to identify and describe Protea species of possible commercial value. In most cases special attention was given to variants of some of the species which may have special commercial value.

The results were reported in Bulletins B.1 "Protea species and variants", B.8 "The bearded proteas", B.9 and B.10 "*P. cynaroides*" and B.12 "*Leucospermum* types". An unpublished report on 30 species of the genus Protea was also compiled.

## Summaries

This work is now finalised because through breeding and selection the emphasis on improving proteas has now moved to the release of cultivars for commercial use.

## PROTEAS

### TAXONOMY

TB.2431/01/1/2: GUIDELINES FOR THE REGISTRATION OF NEW PROTEACEAE.  
1975-1985  
G.J. Brits

A description schedule, according to UPOV directions for the registration of *P. leucospermum* cultivars was completed. With the use of this schedule it is now possible to describe and identify cultivars, to register new cultivars and to register plant breeders rights. A further development was that this schedule was computerised, which enables the registration authority to identify differences between cultivars presented for registration.

With the use of this schedule two new cultivars released by the Horticultural Research Institute were described and registered. They are *P. leucospermum* selections called "Scarlet Ribbon" and "Sunrise".

## PROTEAS

### NUTRITION

TB.2431/05/1/1: NUTRITIONAL REQUIREMENTS OF PROTEAS IN SAND CULTURE.  
1976-1984  
G.J. Brits

This study was conducted with different protea species propagated vegetatively as clones or with cultivars also propagated vegetatively. The protea plants were grown in a sand culture in a greenhouse and irrigated with water or a nutritional medium as required.

The results showed the following:

1. A low pH is not an absolute requirement for proteas, on condition that the different nutrient elements are to the required concentrations and proportion for protea growth
2. Most of the protea species can grow in a relatively high salt concentration, on condition that phosphorus is not too high
3. A study of the soil habitat will give a good indication of the adaptability of most species to different nutritional requirements
4. All species reacted positively to  $\text{NH}_4\text{-N}$ , and the most are susceptible to  $\text{NO}_3\text{-N}$
5. Most species were sensitive to phosphorus in the nutrient medium.

## PROTEAS

### UPGRADING

TB.2431/07/1/1: BREEDING OF PROTEAS. 1978-1984  
G.J. Brits

This facet is being terminated so that three new facets i.e., breeding of protea spp., breeding of *Leucospermum* spp. and breeding of *Leucadendron* spp. can be registered.

This facet progressed very good and resulted in the release of ten *Leucospermum* cultivars and one protea cultivar. They are as follows: *Leucospermum* cultivars - Flamespike, Fire Dance, Pink star, Vlam, (all *cordifolium* selections); Caroline (*tottum* x *cordifolium*); Goldie (*cuneiform* selection); Luteum (*reflexum* selection); Scarlet Ribbon (*tottum* x *glabrum*); Sunrise (*patersonii* x *cordifolium*). The protea cultivar is Guerna which is a *P. repens* selection.

Furthermore, a number of other selections and hybrids developed under this facet is still under evaluation as possible new cultivars.



From the progress already made it is clear that because of the large number of species involved and the diversity of the material (colour, time of flowering, flower shape, stem length, production, etc.), progress with the development of new cultivars through breeding is very promising. It is therefore felt that with the groundwork already done to serve as a basis, progress with this breeding programme will increase with time.

### BULB FLOWER CROPS

#### CROP SCIENCE

TB.2432/30/1/1:                      BULB FLOWER CROPS: MANIPULATION OF THE FLOWERING AND GROWTH PERIOD OF *ORNITHOGALUM*. 1979-1985  
D.I. Ferreira

The influence of storage temperatures and the period of storage on the flowering of *Ornithogalum thyrsoides* Jacq. was investigated. This was done to determine whether production of good quality flowers could be achieved outside the normal flowering season (September to November). A total number of 91 different treatments were applied to the bulbs starting in February 1981. The parameters used were:

- (a) Mass of the bulbs before planting
- (b) Number of days from the time of planting until the appearance of the first inflorescences
- (c) Number of days from the time of planting until the inflorescences were ready to be harvested
- (d) Mean number of inflorescences per plant
- (e) Mean length of the inflorescence stalk
- (f) Mean number of flowers per inflorescence

The results of this investigation can be summarised as follows:

- (a) *Ornithogalum* bulbs can be stored at a temperature of 30 °C for fairly long periods (25 weeks) under the conditions used in this investigation. If higher humidities can be maintained (without the development of diseases) the storage period can even be much longer. When the humidity is not controlled the mass of the bulbs decline with an increase in the length of the storage periods.
- (b) The time lapse from planting until the inflorescences appeared and eventually developed to the stage at which they were harvested, was very definitely influenced by the storage temperatures as well as the duration of the storage. For example, bulbs which were stored at 30 °C for 5 weeks only flowered 200 days after they were planted, while those which were stored at 30 °C for 25 weeks, followed by a storage of 5 weeks at 18 °C and eventually 5 weeks at 11 °C, took only 92 days to flower. The treatments in the second stage (i.e. at moderate temperatures: 18 °, 20 ° and 22 °C for 5 weeks) did not influence the growth period significantly, when compared with each other. The treatments in the third and final stage of storage (11 °, 13 ° and 15 ° for 5 weeks) did influence the duration of the growth period up to flowering. The bulbs which were stored at 15 °C during the final stage, tended to have a longer growth period. As the duration of storage at 30 °C increased, the difference in time lapse among the various treatments, also increased, with those stored at the higher temperatures during each stage, having the longest growth periods. The deduction can, therefore, be made that the inhibitory effect of temperature on the development of the bulbs increased as the temperature increased from 11 °C to 30 °C.
- (c) The duration of the period of storage at 30 °C had a definite effect on the mean number of inflorescences produced per plant, as well as the mean length of the inflorescence stalks. The number of flowers per inflorescence, however, varied to a lesser extent. If the duration of storage at 30 °C alone is considered, regardless of the follow-up treatments, the mean number of inflorescences per plant and the mean length of inflorescence stalks tended to increase from 5 to 15 weeks, whereafter it decreased again. Looking at the different treatments, regardless of the period of storage at 30 °C, it appears as if the higher storage temperatures, enhanced the mean number of inflorescences per plant (treatments 1, 2, 3, 4 and 13). To some extent the same observations were made with regard to the mean number of flowers per inflorescence. Moderate temperatures (22 °C) during the second phase of storage seemed to have enhanced the mean lengths of the inflorescence stalks (treatments 4, 7, 10 and 12). From the treatments listed above it is clear that the temperatures during the final stage of storage also played a role. It seems as if temperatures above 13 °C during the final stage of storage, enhance the mean length of the inflorescence stalk.

Although it is not clear from the results of this investigation, the combination of 30 °C followed by 22 °C, followed by 13 °C, seems to be the most promising treatment.

## Summaries

It is, however, evident that the duration of the storage periods and maybe even the sequence of the second and third stages were not optimal. With regard to the three temperatures it can be concluded that storage at 30 °C inhibits the development of the bulbs; storage at 22 °C enhances the number of inflorescence, as well as the number of flowers per inflorescence, while storage at 13 °C enhances the length of the inflorescence stalk.

### CUT FLOWERS AND POT PLANTS

#### PESTS

TB.2433/20/1/2: CUT FLOWERS AND POT PLANTS: A STUDY OF RESISTANCE OF ROSE ROOTSTOCKS AGAINST ROOT KNOT EELWORMS. 1981-1984  
K.C. Daiber

Most rose rootstock selections are attacked by a root knot eelworm species, namely *Meloidogyne hapla* Chitwood, which causes the formation of galls with a proliferation of lateral roots. A rose rootstock selection which is resistant to *M. hapla* would solve an important problem of the nurseryman.

Experiments were carried out in a land infested with *M. hapla*. The infestation had built up in strawberries which had been growing for several years. The rose rootstock selections Basye 3, Brooks 48 and Clarke 57 became infested by *M. hapla*, especially in the 1983/84 season when more than 90 % of the tested plants showed symptoms, usually all over the root systems. In three seasons the rose rootstock selection Floradale did not show symptoms at all, but in the 1983/84 season 8,3 % of the tested plants showed a few galls in which single females of *M. hapla* were found.

Although Floradale proved to be not totally resistant, it was infested to a significantly lesser degree than the other rootstock selections. In little infested soil Floradale may remain free or nearly free from infestation.

### CUT FLOWERS AND POT PLANTS

#### PESTS

TB.2433/20/1/3: CUT FLOWERS AND POT PLANTS: BIO-ECOLOGICAL STUDIES OF MITES ON CHRYSANTHEMUMS. 1981-1985  
M.C. Bolton

*Tetranychus urticae* populations were studied on chrysanthemums in a commercial glasshouse. The purpose of this study was to obtain the necessary information for further research on the biological control of the mite species by the predator mite *Phytoseiulus persimilis*.

It was found that a gradient of 1 to 2 °C in temperature and 5 to 10 % in relative humidity in the glasshouse were too little to cause differences in the number of mites on the leaves. All areas in the glasshouse were therefore favourable for the mites to breed.

An average of 12 mites occurred on each leaf and the number of eggs were less than 10 on 80 % of these leaves. Ten per cent of the mite population consisted of females and that gave a rough estimate of population numbers.

In February 1983, the American leafminer *Liriomyza trifolii* was detected for the first time on chrysanthemums in South Africa. This pest demands intensive chemical control measures and, therefore, the study on biological control of mites is no longer relevant and had to be discontinued.

### CUT FLOWERS AND POT PLANTS

#### CHEMICAL CONTROL

TB.2433/21/1/1: CUT FLOWERS AND POT PLANTS: CHEMICAL CONTROL TECHNIQUES FOR MITES ON CHRYSANTHEMUMS. 1981-1984  
M.C. Bolton

Until February 1983, *Tetranychus urticae* Koch was the most important pest of chrysanthemums in glasshouses. In 1970 the systemic acaricide, aldicarb, was registered in South Africa but within the following



## Summaries

decade chrysanthemum growers found that its control of *T. urticae* was unsatisfactory. The purpose of this study was, therefore, to investigate the effect on aldicarb on mite populations.

The first series of experiments showed that populations were the highest in the middle zone and lowest on the bottom leaves of the plants. It was also found that flower quality was directly affected by the number of mites present on the petals. Two application practices of aldicarb were followed by the chrysanthemum growers, namely a single dose or two half doses. In two of the three experiments the single aldicarb dose gave significant control of the mites and in one experiment only, the two half doses of aldicarb was significantly effective. The growers were therefore advised to use a single aldicarb dose.

A minimum of 0,2 g aldicarb/plant was necessary to control the mites. Doses higher than 0,3 g aldicarb per plant retarded the population increase.

No significant differences in mite control occurred when aldicarb was applied to plants in pots or open soil. The mite numbers, however, increased more rapidly on plants in open soil than on those in pots. These results indicated that aldicarb was retained in the pots for a longer period.

When aldicarb was applied to plants aged 55 to 75 days, no significant differences in mite control were found. The older plants treated with aldicarb, however, had the additional advantage that mites were still controlled when flowers were cut.

## Pome and stone fruits

### APPLES

#### PHYSIOLOGY

VV.2441/03/2/4:

INDUCTION AND DEVELOPMENT OF LATERAL SHOOTS ON APPLE TREES IN THE NURSERY. 1983-1985

K.I. Theron

There are a number of advantages in using feathered nursery trees, instead of whip-like trees when planting a new apple orchard. Some cultivars such as the Starking types do not feather naturally. A large number of chemical growth regulators have been tested to induce feathers on nursery trees.

It was found that the chemicals M & B 25-105 and Promalin were both effective in inducing feathers on nursery trees. A combination of these two chemicals gave better results with Topred (a Starking type) than when used alone. A model has been presented to describe the role of hormones in the mechanism of inhibition of lateral buds. This model proposes that there are two mechanisms of inhibition, viz an inhibition related to the node position of a bud which is probably related to abscisic acid (ABA), and a second type which is related to the subtending leaf of a bud and which is possibly related to auxin. This model will be evaluated in further studies.

### APPLES

#### PHYSIOLOGY

VV.2441/03/3/1:

MECHANISM OF ACTION OF TRIADIMEFON IN IMPROVING FRUIT SET OF STARKING DELICIOUS. 1982-1985

L. Gouws

Five repeat spray applications at 10 days before full bloom (FB) at full bloom through petal fall (PF) till PF + 20 days of 50 and 100 mg/l, a.i. triadimefon were made on 25-year-old Starking Delicious trees. Similar repeat applications at 14 days before FB and weekly thereafter till PF + 10 days of 50, 100 and 150 mg/l a.i. triadimefon were made on 7-year-old 'Delicious' trees. Treatment resulted in a reduction in the second fruit drop, increase in fruit set and yield without affecting fruit size. Similar applications to flowers or spur leaves with or without blossom thinning were done on 7-year-old 'Delicious' trees. Treatment of any combination of the terminal and lateral flowers gave a poorer set than when all flowers in a cluster were treated. Fruit set per cluster did not differ when triadimefon was applied to only the spur leaves or all flowers in a cluster or both. Triadimefon reduced the surface area of petals, ovary diameter and pedicel length whereas pedicel and ovary dry mass increased. Triadimefon significantly increased the retention of unpollinated flowers.

## Summaries

Spray applications of triadimefon (1-4 chlorophenoxy-3,3 dimethyl 1-*H*-1,2,4 triazol 1-yl-2-butanone, 5 % w.p.) at 100 mg/l<sup>-1</sup>, a.i. at 14 and 7 days before full bloom on 7-year-old Starking Delicious trees increased the number of seeds per fruit. Triadimefon reduced the number of seedless fruit whereas increasing the proportion of fruit with high seed counts. Triadimefon altered the distribution of seeds in the 5 loculi of individual fruit which had 4 to 7 seeds and increased the number of loculi containing 2 seeds. Style removal reduced fruit set to the same extent in treated and control flowers.

During this study methods were developed for the extraction, purification and quantification of the plant growth regulators IAA, ABA cytokinin and GA. The methods included the use of physical-chemical extraction procedures and quantification by bio-test or gaschromatography/HPLC.

## APPLES

### PHYSIOLOGY

VV.2441/03/5/1: DETERMINATION OF CORRECT MATURITY INDEXES FOR APPLES.  
1978-1985  
A.B. Truter

Six maturity indexes were evaluated to determine the optimum picking stage of apples for long-term storage by storing fruit, and observing the development of certain storage disorders and by subjecting the apples to tests by a taste panel for evaluation of taste and appearance.

It was found that all the indexes should be studied together in order to be able to determine the optimum picking stage. It is important that the sampling should commence early, and that maturity tests should be carried out weekly so as to obtain a complete picture of the development of the fruit. A sudden change in the rate of change of the different indexes generally indicates optimum maturity. This stage is usually preceded by a stabilisation period. During the last few weeks prior to harvesting, these indexes changed in accordance with fixed tendencies. These changes were measured and extrapolated in order to predict the date on which the fruit reaches optimum picking maturity. The optimum picking stage of all four apple cultivars studied could be established in this way.

## APPLES

### PHYSIOLOGY

VV.2441/03/6/3: CONTROL OF RUSSETING ON APPLES. 1981-1985  
J. Steenkamp

Gibberellic acid alone or in combination with Golclair increased fruit set while in combination with benzyladenine a slight reduction was observed. In the present study it was found that the fruit number was reduced after the use of GA<sub>4+7</sub> which resulted in bigger fruit with a better average mass for fruit. All the treatments caused a decrease in the average russet index as compared to the untreated ones. Five applications of GA<sub>4+7</sub> plus Golclair and four applications of 10 mg l<sup>-1</sup> GA<sub>4+7</sub> gave significant reduction in calyx-end russet while the latter also gave a significant reduction in peduncular russet. Although all the treatments increased the calyx end opening, no correlation with core rot was found.

## APPLES

### PHYSIOLOGY

VV.2441/03/6/9: INVESTIGATIONS INTO PINK BLUSH OF GRANNY SMITH APPLES.  
1984-1985  
J. Steenkamp

Day and night temperatures of 30 °C or 20 °C, respectively six weeks before harvest could not induce pink blush, in spite of the fact that the trees received additional UV-light equivalent to double of that in day light.



Therefore it was impossible to evaluate the effect of chemical compounds on anthocyanin synthesis and superficial scald.

## APPLES

### NUTRITION

VV.2441/05/1/2: POTASSIUM SUPPLYING POWER OF APPLE ORCHARD SOILS.  
1977-1985  
J. Wooldridge

Parent material has a prime controlling influence on the potassium supplying power of orchard soils. Uptake by pot-grown Italian rye grass from a selection of unfertilised granite subsoils averaged 0,162 me K/100 g soil, as opposed to 0,036 and 0,038 me/100 g, respectively for comparable Bokkeveld shale and Table Mountain sandstone (TMS) soils. Top growth produced on the granite soils and harvested 30 days after germination proved to contain 186 % more K, 25 % less Ca and 19 % less Mg than topgrowth produced on Bokkeveld shale soils. There was, however, no significant difference in dry mass production. At a subsequent harvest the K content of the granite-grown topgrowth was observed to be diminished by an amount which was almost 40 % greater than that measured for the Bokkeveld shale soils, indicating a relative inability on the part of the granite soils to maintain a consistent rate of supply. Despite a 59 % decrease in K content, dry mass production on the part of the granite soils was 17 % higher at the second harvest than at the first, which suggests that excessively high levels of plant potassium may result in impaired growth.

Mineralogically, the clay fractions of the acid subsoils appear to be a function of parent material. The granite soils proved to contain little except Kaolinite in the clay fraction; which may account for their observed relative inability to buffer applied K against loss, whereas the Bokkeveld shale and TMS soils proved to contain vermiculite, chloritised or interstratified 2:1 minerals and quantities of mica in addition to Kaolinite. Liming brings about large increases in both  $PBC_K$  and CEC in these soils. Total acid extractable K correlates with clay content in the case of the Bokkeveld shale and TMS soils, whereas it correlates with fine sand content in the case of the granite soils. The coarser fractions of the granite soils contain weathered orthoclase cores and mica fragments. These represent a source for the seasonal, short-term supply of large quantities of poorly buffered K.

Since luxury potassium uptake with its direct inhibiting effect on calcium content is implicated in both bitterpit in apples and red leaf in table grapes, the level of potassium in granite soils must be particularly carefully monitored.

## APPLES

### UPGRADING

VV.2441/07/1/1: BREEDING OF A GRANNY SMITH-TYPE APPLE WITH A COMPACT  
GROWTH HABIT BY MEANS OF MUTATION BREEDING. 1977-1985  
J.H. Acker

Different irradiation dosages were used during the experiments on dormant buds of Granny Smith and the Witzenberg compact strain of Granny Smith (a natural sport). Positive results were achieved by identifying one tree of a V3 generation that exhibited the desirable degree of compactness. Therefore 52 trees were made from this tree to be further evaluated as bearing trees.

Irradiation of the Witzenberg strain produced a number of trees with varying degrees of compactness. They will again be evaluated as soon as they come into bearing. The remaining trees of the different experiments were established in nurseries where they will be evaluated as normal seedlings.

All mutation breeding work on apples will in the future be carried out under coverage of two facets, viz VV.2441/07/1/6: *In vitro* mutation breeding of Granny Smith to induce compactness, and VV.2441/07/1/7: Culture of Granny Smith plants from callus and single cells for use in mutation breeding. In view of this and the fact that the object was achieved, it is recommended that the facet be terminated. All trees that are already established, however, will be evaluated in the normal seedling evaluation plots.

## Summaries

### APPLES

#### UPGRADING

VV.2441/07/1/4:

#### DEVELOPMENT OF TISSUE CULTURE TECHNIQUES FOR MUTATION BREEDING ON APPLES. 1978-1984

R.E. Pieterse

A series of 30 experiments conducted on shoot tips showed that Granny Smith does not differ markedly from other apple cultivars and rootstocks in its *in vitro* response.

On full strength Murashige and Skoog medium supplemented with 1 mg/l BA and 0.1 mg/l IBA, a multiplication rate of  $\pm 4$  times per month could be maintained. An average of 60% rooting was obtained on half-strength MS medium with 1 mg/l IBA. Phloroglucinol in the shoot proliferation medium had no effect on shoot development as such, but might have enhanced the subsequent rooting ability of such shoots. The effect of adenine sulfate, caseinhydrolysate, gibberellic acid, vitamins, inositol, sucrose concentration, activated charcoal, agar, pH, air supply, nitrogen, KI and light requirements was also investigated, but no marked improvement above the standard technique was found.

The most important finding was that adventitious buds could be induced on the leaves of shoot tips by including 5 mg/l BA + 1 mg/l IBA in the medium. If histological studies should show that these buds develop from a single cell, a technique will be available to obtain solid mutants within one vegetative generation.

Full details on the work are available in a M.Sc. thesis at the University of Stellenbosch.

### APPLES

#### CROP SCIENCE

VV.2441/30/2/1:

#### EVALUATION OF A NUMBER OF IMPORTED APPLE ROOTSTOCKS. 1971-1984

O. Bergh

The performance of 18 different clonal rootstocks was studied in four different localities and soil types during the past 15 years. The following stocks were included in the trials: EM2, EM7, EM26, M778, M779, M789, M793, MM101, MM104, MM105, MM106, MM107, MM109, MM110, MM111, MM112, MM113, MM114, Northern Spy and Seedling. New soil was chosen for all the trials and the possible effect of replant disease was not investigated. Results proved that the M793 and MM109 rootstocks could be considered the best rootstocks for Golden Delicious and Granny Smith. Less vigorous rootstocks, i.e. EM2, EM7 and MM106 did not result in improved yields and although such rootstocks could be spaced closer, the advantages of the closer spacing were offset by the poor growth. These dwarfing stocks reduced vigour drastically and increased the incidence of sunburn significantly.

Vigorous rootstocks, i.e. MM101, MM104, MM113 and MM114 exceeded crops on 793 rootstocks at spacings wider than 2,7 m x 3,6 m on low and medium potential soils. It was evident that the full potential of the M793 rootstocks could not be reached at these wide spacings where the trees would not fill the allocated space sufficiently to intercept maximum solar energy. However, early heavy crops and high density plantings are essential to offset high initial costs and the performance of trees on the M793 rootstocks at the 2,7 m x 3,6 m spacing indicated that it would be the most suitable rootstock on low as well as medium potential soils.

Clonal stocks reduced the vigour of Granny Smith trees more drastically than Golden Delicious and the vigour of full bearing Granny Smith trees on M793 stocks was often insufficient to reduce the incidence of sunburn. Sunburn is a serious hazard in Granny Smith trees and more vigorous trees could reduce the incidence in orchards planted on medium potential soils. The MM109 rootstock is considered superior to M793 rootstocks for this cultivar as it would induce more vigour and develop an improved leaf cover.

Seedling stocks performed poorly in all the trials and poor average yields were recorded owing to the variation in the performance of individual trees. The long maiden period of such trees was a further disadvantage as it would delay the return on capital invested in modern orchards.

The different clonal stocks had no significant effect on fruit size or the incidence of bitterpit. Fruit from trees on EM7 stocks reached maturity approximately 10 days earlier than on remaining stocks.



## APPLES

### CROP SCIENCE

VV.2441/30/3/1:

A COMPARISON OF TRAINING SYSTEMS FOR APPLES IN THE ELGIN AREA. 1966-1985

O. Bergh

The effect of different planting and training systems on the production, fruit quality and nett income of Golden Delicious and Granny Smith cultivars was studied in a planting and training trial at the Grabouw Experimental Farm during 1966-1985. Three training systems, viz palmette, pyramid and vase were planted at three densities, viz 1 500, 800 and 500 trees per hectare for the palmette and pyramid systems and 400 trees per hectare for the vase system.

Results proved that the higher density plantings were more economic than wider spacings and a positive nett cash flow was recorded during the eighth year after planting for Golden Delicious and tenth year for Granny Smith at a planting density of 1 500 trees per hectare. The high cost in planting and training material as well as labour required for establishing these high density plantings, were offset by the increased production of the systems and yields of 100 metric tons per hectare, were maintained during the past nine years. Wider spacing reduced initial costs but production was low during early years and did not offset these initial costs before the ninth year at a planting density of 800 trees per hectare or 10th year at a planting density of 500 trees per hectare in Golden Delicious. Wider spacing with Granny Smith trees were slower in reaching a positive cash flow owing to the less vigorous growth of this cultivar on the Merton 793 rootstocks. A positive cash flow was only recorded after 11 years with 800 trees per hectare and 13 years with 500 trees.

Fruit size proved to be a major factor in maximising returns per hectare and shading in the high density plantings was found to be critical owing to the east-west row direction of the plots. The lower sections of southern walls in palmette rows produced significantly smaller average fruit sizes than northern walls throughout the full bearing stage of the trial. Despite the tendency for these plantings to produce smaller sizes, and a more drastic thinning procedure to limit the reduction of fruit size, these high density plantings proved to be more remunerative than the wider spacings.

Pyramid shaped trees at 800 trees per hectare proved to be as economic as the palmette shaped trees at 1 500 trees per hectare in the Golden Delicious plots. The equal performance of the pyramid shaped trees was not due to equal production levels but rather due to the improved average fruit size of the wider spacing. Shading was less severe in the pyramid shaped trees than in the high density palmette shaped rows and average fruit size was improved.

However, the wider spacing of pyramid shaped trees was not as successful in the Granny Smith plots. Granny Smith trees were less vigorous and did not fill the allocated area as well as the Golden Delicious trees. The reduction in light interception of these smaller trees was related to a reduced crop and income of the wider spaced trees.

The results confirm the economic advantages of high density plantings reported in the UK and Western Europe and proved that the average income from apples in the Western Cape could be increased significantly if high density plantings were considered and managed correctly.

## PEARS

### UPGRADING

VV.2442/07/1/3:

BREEDING OF PACKHAM'S TRIUMPH PEARS WITH A COMPACT GROWTH. 1977-1985

J.H. Acker

Several thousand dormant buds of virus-free Packham's Triumph pears were irradiated with varying doses (55-65 Gy) of gamma rays from a Co-60 source. Three different (V1-V3) vegetative generations were developed. Trees were planted in an orchard. Compactness was determined by measuring internode length. The irradiation experiments were repeated for some years. During 1983 three trees were identified that seemed to be compact. These trees resulted from a V3 generation of the 1980/88 irradiations. Buds (148) were used to develop trees which were planted in an orchard.

Records of internode length were taken on the 148 trees, but measurements were inaccurate owing to

## Summaries

confusion with radiation induced lack of vigour. It was therefore not possible to say whether these trees were really compact. They will, however, be allowed to bear fruit and then be finally evaluated for compactness and fruit characteristics.

In view of the fact that pear mutation breeding work will in the future be covered by the facet VV.2442/07/1/4: *In vitro* mutation breeding of Packham's Triumph to develop compact trees, it is suggested that the present facet be terminated.

The results of this facet were not published. In view of the limited results a publication is not foreseen.

## PEARS

### CROP SCIENCE

VV.2442/30/5/2: FACTORS AFFECTING THE ROOTING AND SURVIVAL OF BP1 PEAR ROOTSTOCKS. 1979-1985  
D.K. Strydom

The BP1 clonal rootstocks are the only clonal rootstocks available for commercial pear production. From a production point of view these rootstocks are superior to seedling rootstocks. Severe problems were, however, experienced with rooting and survival of these clonal rootstocks. So much so that propagation of these stocks was not economically viable for the nursery industry. The objective of this facet was therefore to develop a successful method for the rooting and survival of the BP1 clonal pear rootstock.

During the six year running period of this facet, success has been achieved with the development of a technique, proved to be successful in practice. This technique involves the following steps:

1. Cuttings should be selected in May and the leaves should be removed.
2. Only basal and sub-basal cuttings with a minimum thickness of 7 mm at the basal end should be selected, and cut to a length of 30 cm. Drying out of cuttings should be prevented at every stage.
3. The basal 5 mm should be dipped in 3 500 mg/l IBA for 5 seconds.
4. In order to control possible fungus diseases, the cuttings should be dipped in a mixture of captab (2 g/l), benomyl (1 g/l) and Agral (4,5 ml/20 l), and allowed to dry off after dipping.
5. The tip of each cutting should be sealed with a suitable wound sealer.
6. The cuttings should then be placed in plastic bags to prevent drying out, and be placed in a cold store at 4-5 °C for 4-6 weeks.
7. After cold storage direct planting in the nursery should take place.

## PEACHES

### PHYSIOLOGY

VV.2443/03/4/1: DETERMINATION OF RELIABLE MATURITY INDICES FOR PEACHES AND NECTARINES. 1980-1984  
T.R. Visagie

During the past five seasons research work was done to determine a reliable and practical maturity index for certain commercial and potential commercial peach and nectarine cultivars. This work was directed mainly towards the newly imported cultivars which have been planted on a large scale in some production areas. The cultivars Armking, Sunlite, Independence, Flavortop, Fantasia and Flamekist were harvested at different stages of maturity and stored for 3 and 5 weeks at -0,5 °C. Pressure readings by means of a penetrometer, change in colour and background colour, pH, acid and sugar content (TSS), variation on and between trees and blossoming periods were investigated.

Results showed that penetrometer readings together with colour are the only reliable and practical criterium. Pressures are taken on a sample of 20 to 30 fruit and harvesting is then done according to the colour of the fruit with optimum pressures. Colour could vary from season to season and therefore pressure readings must be taken to show the picker at what stage he should pick. The optimum stage of maturity for the present nectarine cultivars is 5 kg to 7 kg measured with the penetrometer with the 11 mm point. Since the present nectarine cultivars start to ripen at the blossom end and along the suture, the firmness should be determined on the suture about 11 mm from the blossom end and also on the opposite side in order to obtain a reliable index.



## Summaries

Measuring the pH, acid and sugar content proved to be poor criteria of picking maturity. This information could be a good index of quality but not of picking maturity. In South Africa nectarines also bloom over a long period which could be as long as 10 to 14 days. Variations are carried over to the fruit on the tree and between trees with no reliable indication for when the fruit will reach the picking stage. Ripening of nectarines starts from the top to the bottom of the tree and fruit at the tip of the branch also ripen first. This merely gives an indication where to take the first sample for penetrometer readings.

Woolliness is a serious problem of the present nectarine cultivars. Harvesting too immature results in a large increase in the incidence of woolliness. Armking is less susceptible to woolliness but susceptibility increases in other cultivars such as Sunlite, Independence, Flavortop, Fantasia and Flamekist. Because of this problem the present nectarine cultivars cannot be stored successfully for 3 weeks at  $-0,5^{\circ}\text{C}$  owing to the incidence of woolliness.

## PEACHES

### UPGRADING

VV.2443/07/1/3:                   MUTATION BREEDING OF NECTARINES BY MEANS OF  
IRRADIATION. 1979-1985

J.H. Acker

The cultivar Fairtime and Selections 2-13-61, 14-11-90, 14-6-5 and 14-6-53, which are all heterozygous for the nectarine characteristic, were used in the irradiation experiments. It was assumed that heterozygous loci would readily respond to radiation treatment. Tests were run to determine the LD 50 value but this could not be clearly established. The LD 50 seemed to be between 30 and 80 Gy gamma rays.

A Co-60 source was used to irradiate summer as well as dormant scions of the cultivar and selections with different dosages varying between 30 and 80 Gy. Treatments were repeated for two consecutive seasons and three vegetative generations (V1-V3) were developed. Irradiated buds were budded on rootstocks which were planted in an orchard. Bud development was generally very poor so that ultimately only about 600 trees were available for evaluation.

Bearing trees were evaluated for the nectarine characteristic but no nectarines could be detected. Larger populations of irradiated material might produce positive results but this must be weighed against the ease with which the characteristic can be manipulated in a conventional breeding programme. Conventional breeding for nectarines is very successful since the character is inherited as a monogenic recessive. Against this background and in view of the poor results obtained with mutation breeding, it is suggested that the facet be terminated.

Considering the lack of positive results in this experiment, it is not intended to publish the findings.

## PEACHES

### TECHNOLOGY

VV.2443/52/1/1:                   CONTROLLED-ATMOSPHERE STORAGE OF PEACHES. 1982-1985

G.J. Eksteen

The effects of different oxygen and carbon dioxide concentrations in the storage atmosphere and also different periods of cold storage at  $-0,5^{\circ}\text{C}$  on the quality of nectarines were evaluated. These controlled-atmosphere (CA) conditions reduced the ripening rate during storage and the fruit had a very good external quality during the marketing and shelf life period.

Woolliness is a physiological disorder which seriously affects the marketing quality of peaches and nectarines. This disorder was not controlled by CA storage and there are indications that 6 to 10 % carbon dioxide concentrations in the atmosphere may aggravate this disorder. Oxygen concentration is also important in controlling many physiological disorders, but seems to play no role on the development of woolliness.

The quality of the fruit deteriorated with an increase in storage period. The main aim of CA storage is that it lengthens the storage life of the fruit, but in Independence nectarines woolliness increased to as much as almost 90 % after 24 days of cold storage. Woolliness and internal breakdown in Flamekist nectarines also increased to unacceptable levels. It can therefore be concluded that the CA cold storage of nectarines has no potential for South African grown peaches and nectarines.

## PEACHES

### TECHNOLOGY

VV.2443/52/1/2:

#### POST-HARVEST HANDLING AND TREATMENT OF PEACHES TO INCREASE STORAGE LIFE AND QUALITY. 1983-1985

G.J. Eksteen

Nectarines and apricots were cooled directly after harvest and handled in water the next day. Fungicides and wax were applied to evaluate the control of rots and improvement of appearance and quality. It was found that the brushes used to evenly spread the chemicals injured the fruit. This resulted in severe chemical injury and the brush application system was replaced by rollers and belts which did not injure the fruit.

The incidence of rots varied considerably and figures exceeding 50% were recorded in the cultivar Independence handled in water. The application of fungicides in combination with a wax for three consecutive seasons, resulted in very inconsistent rot control. None of the post-harvest-applied fungicides statistically reduced the incidence of rots on nectarines, peaches and apricots. These chemicals cannot therefore be recommended for post-harvest disease control.

The use of post-harvest fungicides and wax also resulted in excessive lenticel injury. This injury was most severe in the case of yellow flesh clingstone peaches. The peaches must first be defussed before the fungicides and wax is applied. During this process microscopic wounds result at the point where the trichome is removed and this wound serves as entrance for the chemicals. Although this is standard procedure for American grown peaches, chemical injury in excess of 60% developed with the same chemicals used in the USA but on locally grown peaches.

Post-harvest application of wax is hardly visible on nectarines and apricots. It therefore does not affect the external quality of the fruit, but it was also found in plums that the thickness of the wax coating is very critical. When applied lightly it does not reduce wilting, but when applied at higher rates it may result in anaerobic respiration which give the fruit a fermented taste.

Many European countries do not allow post-harvest fungicides on stone fruits and because these fungicides are mostly incorporated into wax, this is also not allowed. South Africa exports most of its stone fruits to these countries and can therefore not treat with fungicides and wax. This makes post-harvest treatments of export fruit with fungicides and wax impossible. Severe injury and ineffective rot control makes post-harvest treatments of fruit for the local market uneconomical.

## PEACHES

### TECHNOLOGY

VV.2443/52/1/3:

#### RATE OF PRECOOLING AND STORAGE TECHNIQUES TO IMPROVE STORAGE LIFE AND QUALITY OF PEACHES. 1983-1985

G.J. Eksteen

It was established that peaches and nectarines must be picked at a firmness of 5,5-6,8 kg (11 mm plunger) to reduce woolliness after cold storage. At this stage the fruit is relatively soft and bruises easily during handling and transport. Bruising is considered less at a picking maturity of 9-10 kg firmness. When the fruit is picked at this maturity, it can be handled and transported successfully, but precooling must then be delayed for at least 24 hours after picking. The Flamekist cultivar, however, is very susceptible to internal breakdown which may be aggravated by a delay in cooling.

It was also found that cold storage temperatures between 0,5° and 6,5°C resulted in more woolliness than when stored at lower or higher temperatures. A storage temperature of -0,5°C is therefore recommended for commercial storage and transport.

The results obtained during three seasons indicated that climatic conditions may also be of great importance. This may be the reason for much smaller differences in woolliness between different picking maturities during the 1985 growing season. Despite these seasonal differences, no correlation exists in the incidence of woolliness between the different growing areas within a specific season.

Woolliness seems to be the result of abnormal physiological processes which can be affected by cultivar, climate, growing conditions and picking maturity. The physiological processes are being studied but it is of great importance that resistant cultivars are introduced. This seems to be the only way to ensure a stable peach and nectarine export industry.



## Summaries

### PLUMS

#### UPGRADING

VV.2444/07/1/2:           MUTATION BREEDING OF PLUMS. 1965-1985  
J.H. Acker

A wide range of irradiation experiments were carried out on plums during the past 20 years. Dormant seed, seedlings and dormant scions were irradiated with gamma rays from a Co-60 source. Radiation dosages varied for seeds between 500 and 600 Gy, for seedlings between 20 and 200 Gy and for scions between 50 and 150 Gy. A number of cultivars were used. Vegetative generations 1-3 (V1-V3) were developed. A wide range of irradiated material were therefore available for budding on rootstocks.

Although the experiments were carried out over several years and the trees were thoroughly inspected, no mutations of commercial value could be detected. Leaf abnormalities were observed in Harry Pickstone offspring, but it can be regarded as a curiosity only. Open pollinated seeds of irradiated Laroda were collected. Some seedlings which developed from it were selected for further evaluation, but these results are not related to radiation effects *per sé*.

Despite the fact that the mutation work was carried out over a period of nearly 20 years, covering a wide range of irradiation dosages, several cultivars and plant tissue (seeds, scions and seedlings), no positive results could be obtained. In contrast to mutation breeding, conventional breeding yielded promising results over the same period. In view of this it is suggested that the facet be terminated.

### PLUMS

#### UPGRADING

VV.2444/07/1/3:           PHASE-I EVALUATION OF LOCALLY BRED PLUM ROOTSTOCKS.  
1967-1985  
J.H. Acker

This experiment was planted as free standing trees at Bien Donné during 1977. Twenty-three locally bred plum rootstocks were compared with Marianna virus-free (VF), Marianna virus-infected (VI) and peach seedling. Yield and trunk circumference data were collected over a period of four years. Trunk area was calculated from trunk circumference data and yield efficiency expressed as the ratio between yield and trunk area. Cumulative data for four seasons were statistically analysed. For trunk area the lowest figures represent the best values and are therefore ranked highest.

From the data it is clear that Selection 12-65 and 16-4 are the best rootstocks of the group of 23. Selection 12-65 ranked 13th position for yield and 2nd position for both trunk area and yield efficiency. With respect to the latter parameter, it is only exceeded by peach seedling. Its yield efficiency is however significantly better than that of Marianna VF which ranked 11th. Marianna VF ranked 2nd and 24th with respect to yield and trunk area, respectively. It is therefore clear that 12-65 with its high yield efficiency and dwarfing effect leave ample scope for yield increase per land area by narrower spacing.

Selection 16-4 is a vigorous rootstock as indicated by its 26th position for trunk area and 1st position for yield. It also has a good yield efficiency as illustrated by its 3rd position *versus* the 11th position of Marianna VF.

Rootstocks 7-42, 16-16 and 16-48 are all to some extent dwarfing as indicated by their rank position. For yield and yield efficiency they did not reach the set standard for selection although they were better than Marianna with respect to yield efficiency. They too, therefore, deserve an opportunity for further Phase-2 evaluation. Since four seasons' data have now been collected and analysed, this facet will be terminated.

### PLUMS

#### PATHOLOGY

VV.2444/19/1/3:           POST-HARVEST CONTROL OF FUNGAL DISEASES OF PLUMS. 1982-1985  
J.F. Fourie

Techniques of inoculation which insured consistent high infection rates of *Botrytis cinerea*, *Monilinia*

## Summaries

*laxa* and *Rhizopus stolonifer* were used for studying post-harvest fungal diseases of plums and peaches. In peaches high infection rates were obtained without wounding the fruit when a drop of spore suspension was placed on the fruit surface. In plums, however, wounding was proved to be essential. Infection increased with an increase in spore concentration above  $1 \times 10^3$  spores/ml. Infection by all three fungal diseases was established within 12 h.

The eradivative and protective abilities of different fungicides were evaluated. Lesion development on plums and peaches were greatly inhibited when iprodione (against *B. cinerea* and *M. laxa*), triforine (against *M. laxa*) and dicloran (against *R. stolonifer*) were applied 18 h after inoculation. When applied as a protectant, triforine significantly inhibited *M. laxa* on peaches and plums, while iprodione inhibited *B. cinerea* and *M. laxa*, but only on peaches. Botrytis and monilinia decay of peaches and plums could be controlled as effectively by a dosage of 250 ml a.i. iprodione and triforine for the respective pathogens as a 500 ml/l dosage of each fungicide. The fungicides iprodione and triforine showed, apart from their eradivative action when applied shortly after harvest and protective action during storage, good protective abilities against botrytis and monilinia infection when applied 7 days before harvest.

## PLUMS

### PATHOLOGY

VV.2444/19/1/4:      INFECTION REQUIREMENTS OF MOULDS CAUSING POST-HARVEST  
DECAY OF PLUMS. 1982-1985  
J.F. Fourie

The infection requirements of fungi causing post-harvest decay of plums were studied by determining the time when fruit becomes susceptible to decay, when infections are initiated and the susceptibility to decay of different plum, peach and nectarine cultivars. No decay was apparent on green plum and nectarine fruits inoculated with *Botrytis cinerea*. The fruits, however, became more susceptible 2 to 3 weeks before harvesting. Peaches and plums were susceptible to *Monilinia laxa* at an early stage of fruit development, although at low frequencies. They gradually became more susceptible towards the picking stage. Both peach and plum fruits were already susceptible to infection by *B. cinerea* and *M. laxa* during the early developmental stages, but at a low incidence. Susceptibility increased as the fruit reached picking maturity.

Owing to seasonal variation the susceptibility of different peach, plum and nectarine cultivars to *Monilinia*, *Botrytis* and *Rhizopus* decay could not be determined. The difference in original ripeness and the inability to select fruit of the exact maturity, the following year, evidently caused this variability.

## PLUMS

### TECHNOLOGY

VV.2444/52/1/1:      CONTROLLED-ATMOSPHERE STORAGE OF PLUMS. 1982-1985  
G.J. Eksteen

The effects of different carbon dioxide (CO<sub>2</sub>) and oxygen (O<sub>2</sub>) concentrations in the storage atmosphere at a temperature of -0,5 °C on the storage life and quality of plums, were tested. It was proved that this controlled-atmosphere (CA) conditions resulted in maintaining the good external appearance and quality of the fruit. The ripening rate was reduced and decay was no real problem.

Internal breakdown is a physiological disorder that seriously affects the marketing quality of the fruit. This disorder was not controlled by CA storage and in some cases it was even aggravated. Gas concentrations therefore cannot be manipulated to reduce physiological breakdown in plums and to increase internal fruit quality.

Lengthening of the cold storage period resulted in a dramatic increase in internal breakdown. Although CA storage improves the external appearance of the fruit, it affects the internal quality to such an extent that it has no potential for South African-grown plums.



## Summaries

### PLUMS

#### TECHNOLOGY

VV.2444, 52, 1, 2:

#### POST-HARVEST HANDLING AND TREATMENTS OF PLUMS TO INCREASE STORAGE LIFE AND QUALITY. 1983-1985

G.J. Eksteen

All major commercial plum cultivars were used in experiments conducted over three seasons. The object was to develop post-harvest handling and chemical treatments to reduce rots and to improve fruit quality, appearance and storage life.

During the first year it was proved and confirmed during the following two seasons that chemical treatments should be used only when cold fruit is water handled. When used in this way it was found that the brushes used to evenly spread the chemicals injured the fruit. These injuries serve as entrance points to the chemicals resulting in chemical injury. The brush application system was therefore changed to a belt and roller system which did not injure the fruit.

When wax and fungicides were applied however, chemical injury still occurred. The incidence of this injury varied between 14 % in Ruby Nel and almost 30 % in Santa Rosa. Harry Pickstone and Songold plums did not develop any chemical injuries when handled on a belt system. On brushes, however, severe injuries resulted. The problem with the recorded phytotoxicity is that the results are very inconsistent and varied considerably between cultivars and seasons. Santa Rosa plums handled on belts in 1985 developed more chemical injury in 1983 when handled on brushes. It is therefore impossible to make a firm recommendation regarding chemical injury.

The incidence of rots also varied considerably between seasons and cultivars. The application of fungicides with or without wax resulted in very inconsistent results. None of the fungicides statistically reduced the incidence of rots and in some instances rots even increased. Chlorination of the water in the handling system to prevent a build up of spores did not result in better rot control.

The thickness of the applied wax coating is also very critical. When too thin, no effect on wilting and mass loss is achieved, but when too thick, anaerobic respiration will result. This causes a fermented taste which is completely unacceptable. On nectarines and apricots wax may enhance the appearance, but on plums it removes the natural bloom. This results in a dull waxy appearance after storage. Wax has therefore no cosmetic advantage on plums.

Research is therefore terminated until such time that safe and effective chemicals become available for post-harvest treatments. These chemicals will have to be acceptable on all the export and local markets. The present recommendation of dry handling followed by prompt and effective cooling must still be followed.

### Viticulture

#### TABLE GRAPES

#### PHYSIOLOGY

VV.2461/03/2/2:

#### INFLUENCE OF PRE- AND POST-HARVEST TREATMENTS ON THE INCIDENCE OF SPLIT BERRIES IN THE TABLE GRAPE CULTIVAR ALPHONSE LAVALLÉE. 1980-1981

J.C. Combrink

Four experiments were carried out during each of two consecutive seasons to determine if the incidence of split berry in Alphonse Lavallée can be decreased by manipulating certain cultural and handling practices.

Soil moisture tensions in a commercial vineyard were maintained at 30 %, 50 % and 80 % from the beginning of the ripening period until harvest. During 1981 a soil moisture regime of 50 % was maintained. Vines at each of these regimes were sprayed three times (beginning, middle and end of January) with  $\text{Ca}(\text{NO}_3)_2$  (2,5 kg/500 l  $\text{H}_2\text{O}$ ),  $\text{CaCl}_2$  (1,5 kg/500 l  $\text{H}_2\text{O}$ ), solubor (0,5 kg/500 l  $\text{H}_2\text{O}$ ),  $\text{Ca}(\text{NO}_3)_2$  plus solubor and  $\text{CaCl}_2$  plus solubor. Unsprayed vines in the same vineyard served as controls. The incidence of split berries in the five cartons of grapes per treatment was determined after three weeks at  $-0,5^\circ\text{C}$  plus one week at  $10^\circ\text{C}$ . At a moisture regime of 50 % significant differences were found, but none of the calcium or boron treatments reduced the incidence of split berries compared to the control.

## Summaries

To study the effect of fruit temperature at harvest and sulphur dioxide concentration, Alphonse Lavallée grapes were harvested at temperatures of 24 °C and 32 °C (1980) as well as 21 °C and 35 °C (1981). The sulphur dioxide concentration was varied by using 1, 2 and one commercial sulphur dioxide generator containing 0,30 g to 0,35 g sodium metabisulphite. Control samples were packed without sulphur dioxide generators. After storage for 3 weeks plus 1 week at -0,5 °C and 10 °C, respectively, the incidence of split berries, decay and sulphur dioxide injury were determined. Fruit temperature at harvest had no significant effect on split berries. It is generally believed that berry splitting is lowest at high harvesting temperatures but the highest incidence recorded was in grapes packed at a temperature of 35 °C with one gas generator. There was no apparent relationship between split berry development and sulphur dioxide concentration. Decay was inversely proportional to sulphur dioxide concentration and the incidence of sulphur dioxide injury was negligible at all concentrations.

The effect of fruit temperature at harvest and the polyethylene bag pack was studied by packing grapes similar to those used in the previous experiment with or without polyethylene bags. Where no polyethylene bags were used, sulphur dioxide was applied in the form of 18 ml of a 25 % (m/v) sodium metabisulphite solution. Cold storage and evaluation procedures were similar to those used in the second experiment. There were no statistically significant differences in the incidence of split berries. Decay was similarly unaffected and despite significant differences in sulphur dioxide injury, the results showed no definite trend.

Grapes were kept at constant relative humidities after harvest to determine if split berry development can be induced. Relative humidities of 32 %, 52 % and 98 % were maintained in closed containers by means of saturated solutions of  $\text{CaCl}_2$ ,  $\text{Mg}(\text{NO}_3)_2$  and  $\text{CuSO}_4$ , respectively. The experiment was done in triplicate and each replicate consisted of three 400 g grape samples. The loss of mass and incidence of split berries were recorded after 24 h at 20 °C. The incidence of split berry was not correlated with relative humidity. Loss of mass was naturally inversely proportional to relative humidity.

It was concluded that the incidence of split berries cannot be decreased by maintaining a specific soil moisture regime or by applying pre-harvest calcium and boron sprays. Furthermore, the manipulation of certain post-harvest handling practices did not decrease the incidence of split berries.

## WINE GRAPES

### PHYSIOLOGY

WW.2462 '03' 111: THE CONTRIBUTION OF LATERAL SHOOTS TO CLUSTER NUTRITION AND TO RESERVES IN WINE GRAPES: CAPE RIESLING. 1981-1985  
A.C. de la Harpe

The aim of this study was the determination of the nutritive contribution of lateral shoots to cluster development and nutrition in order to determine the possible advantages of induced laterals for viticulture.

The effect of topping on the vegetative and reproductive growth as well as the chemical composition and concentration of sugars, organic acids and mineral elements in berries of a *Vitis vinifera* L. cv. Cape Riesling was investigated. It was found that topping doubled shoot length and leaf area, increased the influx of photosynthetate to the bunch and increased the N content of the berry. The sugars and acids in the berry itself, however, did not show any significant ( $P = < 0,05$ ) differences.

Shoot and leaf growth of both the topped and untopped vines, respectively, can be described as sigmoid. Total shoot length (cm) and total leaf area ( $\text{cm}^2$ ) of topped vines were significantly more than that of untopped vines ( $P = < 0,05$ ), attributable to lateral shoot growth in the case of the topped vines. Topping had no effect on bunch development. The skin, pulp and seed development with time of both the topped and untopped vines expressed as a percentage of total berry dry mass can be described by a hyperbolic function for the skin, whereas the development of the pulp is linear and that of the seed parabolic. The leaf area correlated positively with different sugars and mineral elements but were negatively correlated with the acids. A very low correlation coefficient ( $r = 0,05$ ) was obtained between the leaf area and dry mass of the berry. The berry volume was highly correlated with glucose, fructose and total sugars indicating that not only did the sugar concentration increase but an increase in berry volume also took place. Contrary to sugar, acid were highly negatively correlated ( $r = -0,09$ ) with berry volume which meant that as the berry volume increased a decrease in concentration of acids was evident. The dry mass of the berry was positively correlated ( $r = 0,85$ ) with the berry volume as well as with fructose ( $r = 0,91$ ), glucose ( $r = 0,87$ ) and total sugars ( $r = 0,89$ ). With increased dry mass per berry a decrease in all acids measured was obtained.

Multidirectional translocation of organic compounds took place. Bunches, shoots and leaves were sinks at veraison whereas leaves were the only sink at harvest. Topping had no effect on the total sugar and total



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acid concentrations in the berry expressed on a dry mass basis. The fact that leaf area and shoot growth were increased by topping led to an increased influx of labelled photosynthetate to the bunch as a whole which could not be determined in the berry alone.

From this investigation it would seem that judicious topping could have beneficial effects on berry composition and could be recommended in vigorously growing vineyards under local conditions. It is quite conceivable that the severity and timing of topping will greatly affect bunch and berry composition as well as various aspects of vegetative growth.

## WINE GRAPES

### CROP SCIENCE

WW.2462/30/4/1: EFFECT OF A SAND LAYER ON WATER INFILTRATION AND THE PERFORMANCE OF WINE GRAPES ON A HEAVY-TEXTURED SILT SOIL: OLIFANTS RIVER VALLEY. 1984-1985  
L. van Huyssteen

A co-operative experiment was conducted on the farm of Mr W.J. van Zyl, a farmer in the Vredendal district.

Four cultivation treatments were compared, viz:

- (1) Sand cover of 75 mm thickness on the surface - chemical control of summer weeds, no cover crop.
- (2) Sand as in (1), but the sand was incorporated into the surface soil by discing and clean cultivation - rye as cover crop.
- (3) Legume cover crop. Clare subterranean clover was tried unsuccessfully for the first three seasons, later vetch was used. Chemical control in early spring.
- (4) Wimmera cover crop. Chemical control in early spring.

An application of 100 t ha<sup>-1</sup> of municipal compost was compared to a control (no application) on a split-plot basis.

Despite the almost total lack of statistical differences in vine performance, invaluable experience with regard to cover crop control in vineyards was gained on a practical basis. The inability to control irrigation, because of circumstances in the experiment, probably caused this lack of vine response.

The following general conclusions could be made from experience on this experiment:

- A surface cover of some kind is effective in reducing surface crusting and slumping of the unstable silty topsoils found in the area.
- High application rates of compost (100 t ha<sup>-1</sup>) had no other effect than to slightly decrease bulk densities in the topsoil layers.
- Water infiltration was improved by a surface cover (both sand and dead plant material).
- The presence of a mulch of dead plant material on the surface could control summer weeds biologically until the end of April.

## Citrus and subtropical crops

### CITRUS

#### NUTRITION

SS.2481 05 1 5: AN INVESTIGATION INTO FACTORS AFFECTING THE FRUIT SIZE OF CITRUS. 1977-1984  
S.F. du Plessis

The purpose of this investigation was to evaluate different practical measures for the improvement of fruit size of mature Valencia trees.

The following factors were tested out in a field trial: hand thinning of fruit (i.e. removal of 50 % of the

## Summaries

fruit) at three stages, viz October, November and January; Gibberillic acid spray; pruning (removal of leaves and twigs to a depth of 60 cm); summer girdling of the main stem and potassium sulphate sprays.

The pruning treatment resulted in a 17 % improvement in fruit size the second season after pruning. It also appeared that yield, which was practically zero during the first season, was almost back to normal. Owing the drought in the subsequent season the long-term effect of pruning could not be determined.

Summer girdling of trees was shown to improve fruit size with approximately 7,5 %, but had no residual effect the next season.

Gibberillic acid sprays resulted in reduced yield and fruit size. Potassium sulphate sprays in December and January at a concentration of 4 % resulted in a 10 % increase in fruit size and a 21 kg per tree increase in yield. Similar results were obtained in an adjacent block where potassium nitrate was sprayed. Therefore, potassium sulphate can replace potassium nitrate to improve fruit size.

Hand thinning of the small fruit was shown not to improve on fruit size, despite a drastic reduction in yield. Therefore, the thinning of fruit (either by hand or chemicals) should be approached with caution as a severe loss in income may result.

These results have shown that pruning will definitely improve fruit size, although yield loss must be taken into account. Summer girdling and potassium sprays were also shown to have a beneficial effect on fruit size.

## CITRUS

### VIROLOGY

SS.2481/19/2/2: INDEXING OF CITRUS FOR TRISTEZA AT MESSINA. 1976-1982  
J.N. Moll

The Messina farm citrus orchards were established from seed in a remote area in an attempt to create a totally virus free, true to type, citrus budwood source. Tristeza disease, vectored by the black citrus aphid, *Toxoptera citricidus*, however, appeared on the farm and is spreading among the trees.

A new strategy is now being employed whereby all material from the farm to be moved to the foundation block is first put through shoot tip-grafting to free it of tristeza and then pre-immunised with a mild strain of the virus.

## CITRUS

### PESTS

SS.2481/20/1/1: INTEGRATION OF BIOLOGICAL AND CHEMICAL CONTROL OF  
CITRUS PESTS: SIMULTANEOUS BIOLOGICAL AND CHEMICAL  
CONTROL OF CITRUS PESTS. 1967-1985  
E.C.G. Bedford, W.J. du Toit, T. Anderson and I.J. Bruwer

Although red scale, *Aonidiella aurantii* (Mask.), *Chrysomphalus aonidum* (L.) and *Lepidosaphes beckii* (Newm.), can be brought under successful and complete biological control on citrus in South Africa, growers and chemically-orientated entomologists were at first reluctant to accept integrated-control programmes. When red scale suddenly became resistant to parathion in particular, growers were forced to adopt an integrated spray programme.

Natural enemies for all three scales had already been introduced and established in presently nearly one third of the nine million citrus trees established in South Africa and they are now under integrated programmes. These programmes can be extended throughout most areas. Pesticide costs are often reduced by 50 % or more.

## CITRUS

### PESTS

SS.2481/20/1/4: EFFECT OF SOIL FAUNA IN CITRUS ORCHARDS ON PEST INSECTS  
IN THE ORCHARDS. 1980-1985  
F.F. Fourie

A cheap and simple but very effective variation of the Tullgren extraction unit was designed and



## Summaries

constructed. It consisted of a top part with 9 light bulbs and 36 funnels and a bottom part containing 36 collecting bottles. This extraction unit was operated in a temperature-controlled room. The temperature in the unit was set to specific levels by means of a dimmer switch. Extraction was carried out over a period of 5 days with a temperature range of 24 °C to 46 °C.

The following families of Acari were represented in the samples: Ascidae, Bdellidae, Cheyletidae, Cunaxidae, Eupodidae, Lealaptidae, Nanorchestidae, Oribatei, Pachygnathidae, Pachylaelaptidae, Phytoseiidae, Pyemotidae, Rhagidiidae, Rhodacaridae, Stigmaeidae and Tydeidae.

Owing to the low numbers of predatory mites it was impossible to determine their effect on citrus pests such as citrus thrips (*Scirtothrips aurantii* Faure) and fruit flies (Tephritidae).

## CITRUS

### PESTS

SS.2481/20/2/1: EELWORM STUDIES: THE EFFECT AND CONTROL OF NEMATODES ON CITRUS. 1971-1985  
P. Willers

The object of this study was to introduce alternative control measures for citrus nematodes. Since the withdrawal of DBCP this study became imperative. Measures to counter specific re-plant symptoms also received attention.

Fenamiphos, applied at a rate of 4 g a.i./m, gave effective control of citrus nematodes. The basipetal translocation properties of the chemical ensured control to a depth of 1,0 m throughout the root system of bearing trees. An average yield increase of 6,8 t/ha could be demonstrated at various trial sites following nematode control for two successive seasons.

Nematocide applications led to a more favourable fruit size distribution. Small fruit (< 63 mm diameter i.e. count 138 and smaller) decreased from 47,5 % to 31 % and from 40 % to 19 % in two separate trials, respectively.

Control of citrus nematode culminated in significant increases in the uptake of K and Cu, and a decrease in Mg. Increases in N, Ca and Zn came close to being statistically significant.

Low dosage rates of both fenamiphos and aldicarb were effective to counter re-plant symptoms and restore normal growth under re-plant conditions. Three applications of these chemicals were effective in reducing initial nematode populations of 66 000/10 g roots to insignificant levels over a 15-month period.

Methylbromide applied under gastight covers, at a rate of 680 g/13,8 m, proved effective as a soil sterilant for citrus nursery use. Inhibition of seedling growth as a result of toxic bromide residues could be avoided by applying a leach of 150 mm water.

A highly significant negative correlation between nematode density and yield of navel trees was demonstrated. Yield loss was determined at six increasing levels of population density. Yield difference between the extreme infestation categories (0-10 000 and > 100 000 nematodes per 10 g) was 64,4 kg/tree.

A study of the root distribution and associated nematode populations indicated that rough lemon rootstock has a relative shallow root system (1,0 m) compared to that of Troyer citrange rootstock (1,8 m). The largest concentration of feeder roots for both rootstocks occurred in the 20-40 cm soil layer. Nematode populations in the root zone of rough lemon rootstock were closely related to root distribution. In Troyer rootstock, this correlation was not obvious and soil populations, in particular, were concentrated in the top soil layer (surface to 200 mm depth).

Leafdrop on citrus growing under saline conditions was investigated. It was found that a direct correlation existed between nematode populations and excessive chloride uptake. Chloride levels in leaves of heavily infested trees exceeded the tolerance level for citrus as a rule, whereas normally growing trees were lightly infested.

## CITRUS

### CROP SCIENCE

SS.2481/30/2/6: CITRUS CULTIVARS AND SELECTIONS: LEMONS. 1972-1983  
C.F. Human

The aim of this investigation was to evaluate five promising lemon selections in two climatic zones in order to find the most suitable selection for commercial plantings.

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The five selections used were as follows:

1. Frost nucellar Eureka
2. Addo Eureka
3. Addo Lisbon
4. Citrusdal Eureka
5. Cooks Eureka

Fruit yield, fruit size and internal quality were compared for seven seasons at Friedenheim near Nelspruit, and for four seasons at the Sundays River Research Station near Addo.

At Friedenheim the best income, yield and internal fruit quality were obtained from Frost nucellar Eureka. Citrusdal Eureka also performed well.

At Addo the best income and yield were obtained from Cooks Eureka with Frost nucellar Eureka the second best. The best internal fruit quality was also obtained from Frost nucellar Eureka.

In general the best results were obtained from the planting at Addo.

## CITRUS

### CROP SCIENCE

SS.2481/30/3/1: SOIL RECLAMATION AND REPLANTING OF CITRUS (ZEBEDIELA AND ADDO). 1969-1982  
W.P. Burger

The effect of five soil treatments and soil reclamation on the performance of citrus trees on rough lemon rootstock established on old citrus soil were evaluated at Addo in the Sundays River Valley and Zebediela in Central Transvaal.

Methyl bromide (500 g/40 m<sup>2</sup> soil), Na-n-methyl-thiocarbamate (2 kg/40 m<sup>2</sup> soil) and chloropicrin (2 ml/m<sup>2</sup>) were applied as replanting treatments. Aldicarb was applied 6 months after the establishment of the trees. Soil reclamation was conducted by the application of 8 ton gypsum/ha and leaching with 900 mm irrigation in three applications.

The influence of the treatments over a period of 10 years indicated that soil reclamation had no significant effect on tree performance. Of the soil treatments applied, only methyl bromide significantly improved tree performance and depressed citrus nematode populations. Methyl bromide had a beneficial effect on the uptake of potassium but suppressed the uptake of phosphate and magnesium. It also suppressed the uptake of sodium, resulting in better tolerance of the tree to brack soil conditions.

Although methyl bromide could be used to suppress the deleterious effect of root parasites when replanting old citrus soils, it is too expensive as a practical measure for the control of biological factors involved in the replant problem of citrus under field conditions.

## PINEAPPLE

### CROP SCIENCE

SS.2482/30/1/5: OPTIMUM PLANT SPACING FOR PINEAPPLES. 1978-1985  
E.R. Dalldorf

Eight spacings of Queen suckers and stumps on both ridged and unridged soil were evaluated at the Levubu Experiment Farm.

Queen suckers yielded significantly less than stumps. Stumps in single rows (population 28 779 plants/ha) and stumps in double rows (population 37 744 plants/ha) gave highest yields for both ridged and unridged conditions.

The results indicate that the cultural practices at Levubu are more in keeping with those of the Eastern Cape than the Zululand area. This could be attributed to the excessive vegetative growth in Zululand compared to the other two areas.

The potential value of ridging was possibly obscured by the severe drought which prevailed during the study. It was apparent that higher fertiliser applications should have been received by the higher plant populations for optimal results.



## DIVERSE SUBTROPICAL FRUITS

### NUTRITION

- SS.2485/05/1/1: MISCELLANEOUS SUBTROPICAL FRUITS: MACRO- AND MICRO-ELEMENT REQUIREMENTS OF LITCHIS. 1968-1981  
T.J. Koen, W. Langenegger and G. Smart

The purpose of this investigation was to determine leaf and soil analysis norms for mature litchi trees (*Litchi chenensis*) to be used for fertiliser advisory purposes.

Two field experiments on 11-year-old trees planted on a Fernwood soil series with a low P and K status, were used for this investigation. In the first experiment, three levels of N, P and K in all combinations were compared and in the second experiment five N levels were compared. Yield and fruit quality were used as criteria.

From these results it is obvious that N had a very marked effect on yield and fruit quality. Optimum leaf N levels (obtained from data of the four seasons separately) were in the region of 14,4 to 15,5 N/kg oven-dried material.

A yield reaction to applied phosphorus can only be expected if the soil P is fairly low, i.e. below 6 mg P/kg soil (an ion exchange resin extraction). Optimum leaf composition is between 1,5 to 1,7 g P/kg.

Potassium had no effect on yield and only a small effect on fruit quality. It was therefore concluded that a soil K level (ammonium acetate pH 7 extract) of 50 mg/kg is sufficient for litchi trees and that the K level in the leaves should be at least 9,5 g K/kg, for optimum production.

This investigation has shown that N is the most important element for optimum yield and fruit quality of litchi trees. It has also shown that leaf and soil analysis can be used for fertiliser advisory purposes.

## Sundry horticultural crops

### HORTICULTURAL CROPS

#### PHYSIOLOGY

- TB.24/11/03/1/1: RAPID PROPAGATION OF SUNDRY HORTICULTURAL CROPS: GUAYULE THROUGH TISSUE CULTURE. 1980-1985  
J.G.J. van Rensburg

Growing tips and single bud cuttings were used as explant material. The basal medium (BM) consisted of a modified Murashige and Skoog medium. Multiple shoots were formed when cultured on the BM with 2 mg/litre benzyl amino purine. Shoots were rooted on BM containing 0,5 to 2,0 mg/litre indole butyric acid.

A high percentage of explants turned brown and subsequently died after a few days on the medium. The season, genotype and condition of the mother plants may be factors involved in the browning of tissue. Less browning occurred when cultures were stored in the dark at 4 °C for a week.

It is possible to obtain 200 shoots from one explant within 12 weeks. The rooting of shoots was not as successful.

This technique of propagation can be applied with reasonable success.

### HORTICULTURAL CROPS

#### PHYSIOLOGY

- VV.24/11/03/1/2: HORTICULTURAL CROPS: THE MORPHOLOGY OF RED AND WHITE SEED OF RED TEA. 1982-1985  
C. Perold

A SEM study of seed-coat patterns of permeable and impermeable seeds of rooibos tea (*Aspalathus linearis*), was conducted. The unsatisfactory germination of the seeds is one of the main problems facing the

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tea industry. Viable seeds cannot always imbibe water and therefore fail to germinate. The inability to imbibe water is generally termed impermeable or hard seed. A rooibos tea plant produces both permeable (non-hard) and impermeable seeds. The tea industry uses an acid scarification procedure to improve germination. Various morphological features have been suggested to act as barriers against permeation of water in the seed-coat of various species of Leguminosae, the family to which *Aspalathus* belongs. All the features are located in or on the outer, palisade layer.

A major difference was found between the seed-coat morphology of the impermeable seeds and that of the permeable seeds. The impermeable seed-coat has a smooth texture as opposed to the rough texture of the permeable seed-coat. The effect of acid scarification on the seed-coat pattern and the hilum was also investigated. It is suggested that the surface structure of the impermeable seed-coat is the reason for the impermeability of the seed.

## HORTICULTURAL CROPS

### PHYSIOLOGY

VV.24/11/03/2/1: HORTICULTURAL CROPS: SELECTION AND STIMULATION OF  
NUCELLAR EMBRYOS OF DATES. 1982-1985  
L.J. von Mollendorff

For three seasons it was possible to identify a big number of abnormal dates at Henkries, but none of these so-called nucellar embryos germinated. This year a great number of these abnormal seeds have been investigated with the assistance of Dr Reuveni (an authority in this field) for nucellar embryos, but without success.

According to Dr Reuveni a possible reason for this phenomenon may be that the abnormal dates from Henkries do not have the typical crimped appearance of the date seeds that contains nucellar embryos.

## HORTICULTURAL CROPS

### PHYSIOLOGY

VV.24/11/03/2/3: HORTICULTURAL CROPS: ROOTING OF SMALL DATE OFFSHOOTS.  
1982-1984  
L.J. von Mollendorff

Small date offshoots of sizes varying from 100 g to 4 000 g were planted in a mist bed to promote rooting. Perlite was used as a rooting medium. Initially the soil temperature was kept at 22 °C, but increased to 30 °C after 6 months. The misting system was set at 60 s every 20 min. Fungus infection was effectively controlled by a weekly application of cabtab (2 g/l) and benomil (1 g/l). The fungicide application was decreased to one every two weeks after 6 months and to one per month after a year.

After a period of two years 75 % of the offshoots had rooted and was planted out in pots. The various treatments with hormones and seaweed extracts had no effect on rooting. Most of the offshoots which died, were the ones smaller than 1 kg and those without any original roots.

The practical application of these results is that offshoots can be removed from the mother tree at an earlier stage, thus allowing for more offshoots to develop and relieve the stress of the offshoots from the mother plant.

## HORTICULTURAL CROPS

### UPGRADING

VV.24/11/07/1/1: HORTICULTURAL CROPS: MORPHOLOGICAL STUDY OF THE  
BREEDING STRUCTURE OF RED TEA TYPES. 1983-1985  
J.H. Acker

For the purpose of this study, flowers were classified in four distinguishable developmental stages. Pollen was collected within each of the developmental stages and stored in the deep-freeze. Standard



methods as being used for deciduous fruit crops, were utilised. The results conclusively show that pollen can be stored with success up to four weeks. During stage 1, when flowers are still underdeveloped, pollen cannot be stored successfully. Pollen remains viable in the keel of the flower for a considerable period after shedding.

Pollen tube growth in the style was successfully filmed. The fluorescence microscope technique, as being used for deciduous fruits, therefore seems to be an useful tool in studying the floral biology of red tea. The results indicate that no pollen tube growth occurred during stages 1-3 although flowers are readily accessible for insects during stages 2-3. During stage 4 nearly 80 % of the styles indicated pollen tube growth. The latter indicates that flowers are pollinated fairly late in their development. It further seems feasible to conclude that a time barrier separates the function of the different floral parts.

Crosses on both emasculated and unemasculated flowers yielded no results. Artificial, controlled hand-pollinations therefore cannot be effected in red tea. Efforts to obtain self-pollinations by covering clusters of flowers with cheese cloth and glycine bags were equally unsuccessful.

In view of the fact that no controlled crosses or self-pollinations can be effected with red tea, it is suggested that the facet be terminated. The economic value of the crop does not justify the pioneering work required to ensure success with crosses.

## PLANT PROTECTION RESEARCH

### Entomology/Zoology

#### INSECTS

##### TAXONOMY

- PB.2511/01/1/2: TAXONOMY AND DISTRIBUTION OF ISOPTERA IN SOUTHERN AFRICA. 1955-1984  
J.L. Sheasby

With the death of the responsible officer during 1984, no detailed progress report covering the period under review can be presented. The termite collection which consists of 34 000 series preserved in alcohol, is one of the largest in the world and with the termination of this facet, will be curated by the National Collection of Insects.

It is hoped that in the near future it will be possible to appoint a suitable young entomologist to continue the work done by Dr Coaton and Mr Sheasby.

#### INSECTS

##### INTEGRATED CONTROL

- PB.2511/23/2/1: THE INTEGRATED CONTROL OF THE VINE MEALYBUG, *PLANOCOCCUS FICUS*, ON VINES. 1978-1985  
A.J. Urban

*Planococcus ficus*, the most serious insect pest of grapevines in the south-western Cape Province, is apparently native to Asia. Studies aimed at improving its integrated control were carried out in the laboratory and in wine and table grape vineyards between Stellenbosch and De Doorns. *P. ficus* is mainly attacked by indigenous predators and introduced parasitoids. The Central American wasp *Leptomastix dactylopii*, introduced in 1935, is ubiquitous, while the south-east Asian *Pauridia peregrina*, first recorded in South Africa in 1963, is sometimes dominant. Parasitism of *P. ficus* peaks in late summer, and can reach 75 % of the final instar. A supplementary parasitoid, *Anagyrus pseudococci*, imported from Israel in 1975, was bred in the laboratory and released at a number of sites. It established only temporarily on the coastal plain, but has been recovered for 4 years post-release in the Hex River Valley, where it has captured nearly 50 % of the parasitism.

Initial establishment of an adequate natural enemy complex occurs slowly if the vineyard is isolated from bio-control areas and no introductions are made. Establishment can, however, be accelerated artificially.

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After establishment, the rate of bio-control is high under favourable conditions: in late summer the natural enemy complex can achieve up to 85 % control of *P. ficus* in 8 weeks, with control increasing thereafter.

Under good management, the degree of pest control obtained by biological/integrated means can be consistently as good as that obtained by purely chemical means, and sufficient not only on wine grapes but also on table grapes, even in the Hex River Valley.

The following practices were found to favour natural enemy activity. Practices (1)-(3) and perhaps (4) are necessary for biological/integrated control of *P. ficus*, the remainder are beneficial.

1. Excluding ants - the most effective insecticide at present is chlordane. Poison baits merit development. Sticky-banding trunks of trellised vines can exclude ground-nesting ants and snout beetles simultaneously, but the polybutenoids are phytotoxic to grapevines and should only be used in conjunction with a foundation material.
2. Withholding insecticides - this includes all insecticides registered for mealybug and most of those for snout beetle control, because they either eliminate the natural enemies along with the pest, or, in the case of fenvalerate and permethrin, eliminate the natural enemies selectively and so stimulate the pest. An integrated pest management programme could include cypermethrin or deltamethrin (as alternatives to biological or physical measures) for snout beetle control if necessary (at the risk of spider-mite repercussions), and endosulfan or triazophos (not registered) for thrips control on table grapes.
3. Ceasing intensive insecticide usage on adjacent land.
4. Withholding fungicide dusts containing talc. Sulphur dust, however, permits bio-control, even when applied every 10-14 days.
5. Establishing natural enemies - besides insectary-reared natural enemies, mealybug-infested grapevine, fig and citrus material can be introduced from neglected sources. Spraying sucrose early in the season and/or post-harvest arrests ambient beneficial insects and increases their longevity.
6. Employing a cover crop.
7. Avoiding excessive nitrogenous fertilisation plus irrigation.

It was concluded that integrated pest management, based on bio-control of *P. ficus*, strongly merits more extensive utilisation, to prolong the useful life of insecticides, to increase the profitability of wine grape farming, and to improve the health of table grape farming.

## INSECTS

### INTEGRATED CONTROL

- PB.2511/23/4/1: BIOLOGY OF PARASITIC WASPS (HYMENOPTERA) ATTACKING SCALE INSECTS OF ECONOMIC IMPORTANCE. 1980-1985  
G.H. Walter and H. van Hamburg

Many species of aphelinid and encyrtid wasps are important in the biological control of scale insects and mealybugs. While their morphology has generally been well studied their developmental biologies are poorly understood. For this reason many species have failed to establish themselves when they have been released in biological control programmes. The object of this study was to investigate the biologies of useful parasitic wasps so that they could be successfully mass-reared for use in the integrated control of scale insects.

The taxonomy of *Coccophagus bartletti* and two other closely related species were clarified. In addition, the basic biology of *C. bartletti* and *C. atratus* was thoroughly investigated. The work on *C. bartletti* lead to a new hypothesis being proposed on the significance of the unusual host relationships in aphelinid parasitoids. Research on *C. atratus* demonstrates how a species with hyperparasitic males finds hosts and how sex ratios are governed.

## NEMATODES

### PESTS

- PB.2512/20/1/3: INFLUENCE OF NURSERY PRACTICES ON THE NEMATODE POPULATION IN VINEYARDS IN THE WESTERN CAPE. 1982-1985  
W. Pieterse

From a survey of 291 registered vine-producing nurseries in the western Cape, the soil of 157 nurseries



## Summaries

was found to be infested with at least 10 *Cricinemalla xenoplax* per 250 ml soil. This plant-parasitic nematode was also found to occur in many vineyards.

In the soil, populations of *C. xenoplax* appear to be most affected by soil moisture. From glasshouse trials the life cycle of this nematode is longer than the 25 to 34 days reported by an overseas worker.

Host specificity tests were carried out on apricots, plums, pears, peaches and grapes. Preliminary results indicated that at the inoculum levels used, *C. xenoplax* infestations reduced the wet mass of apricot plants, had little effect on plums and appeared to stimulate the growth of pears, peaches and grapes. It is suggested that the pathogenicity of *C. xenoplax* on these crops, and especially grapes, be further investigated.

## NEMATODES

### PESTS

PB.2512/20/1/4: THE USE OF TISSUE CULTURE TECHNIQUES TO BREED  
ECONOMICALLY IMPORTANT NEMATODE SPECIES *IN VITRO*.  
1984-1985  
A.P. van Mieghem

Between the commencement of the facet and the transfer of the responsible officer to the Directorate of Plant and Seed Control, sections of tomato, cucumber and *Tagetes* sp. roots were grown on a nutrient medium, and successfully inoculated with *Meloidogyne* sp. Infested roots were stained to study the life cycle of the nematode and the development of the galls.

Various mediums were made and tested while pure *Meloidogyne* cultures were kept *in vitro*. A technique was developed in which the growth points of vines were excised and used for callus and bud formation.

## NEMATODES

### PESTS

PB.2512/20/2/3: SURVEY OF *XIPHINEMA* SPP. THAT OCCUR IN VINEYARDS ON THE  
BANKS OF THE BERG RIVER. 1983-1985  
E. van Reenen

In the Berg River Valley, 36 farms were sampled to establish the various species of *Xiphinema* present in the vineyards. The following species of *Xiphinema* were recorded: *Xiphinema pachtaicum*, *X. brevicolle*, *X. index*, *Xiphinema americanum*, *X. vanderlinde*, *X. parvistilus*, *X. meridianum* and *X. elongatum*. From the available literature it would appear that this is the first time that *X. index* has been recorded in this district. Measurements made of the nematodes collected indicated that certain features within the *X. elongatum* group fell without those already defined for these species.

## HONEY-BEE

### NUTRITION

PB.2516/05/1/1: STIMULATORY FEEDING OF HONEY-BEES. 1972-1985  
J.M. Herrmann

An analysis of pollen samples from two major bee-plants, *Aloe davyana* and *Eucalyptus gomphocephala*, have indicated that both had an extremely high crude protein and fat content.

White or yellow sugar was found to be suitable for the feeding of honey-bees in the field. However, owing to the impurities in yellow sugar a preservative such as parahydroxybenzoate is needed to prevent fermentation.

## HONEY-BEE

### BEHAVIORAL STUDIES

- PB.2516/28/1/2: DEVELOPMENT AND TESTING OF BEESWAX FOUNDATION OF GREATER CELL SIZE THAN THAT CURRENTLY EMPLOYED IN SOUTH AFRICA TO INCREASE THE PROFITABILITY OF HONEY PRODUCTION THROUGH MINIMISATION OF WAX REQUIRED FOR COMB CONSTRUCTION. 1981-1985  
H.R. Hepburn

The aim of this research facet was to determine the greatest cell size of supplied foundation which honey-bees would work.

The mechanical properties of beeswax foundation were investigated and found to be remarkably sensitive to cell orientation. Specimens tested in a direction normal to that usually used in the frame were nearly 40 % stronger. This means that comb-in-frame strength, for the same mass of foundation, can be increased simply by cutting the rolled wax sheets in a direction normal to that now used commercially. Alternatively, this orientation would allow for considerable reduction in the mass of wax used for manufacturing sheets of foundation. Bees will work foundation regardless of the way it is attached to the frame.

Test samples of wax foundation with cell numbers ranging from 1 902 to 170 cells per square decimeter were developed. Small apiary trials were conducted with about 15 different cell sizes of foundation to determine the cell size which was most economic and which all hives tested drew evenly and fully. It was found that this cell size was about 493 cells per square decimeter compared with the 1 000 to 1 050 cells per decimeter in foundation commercially available in South Africa.

Foundation sheets with 493 and 1 022 cells per square decimeter were tested for their honey wax ratio's by placing full frame sheets into standard shallow Langstroth super frames. No significant difference was found between the mass of honey in combs drawn from the two different foundation sheets, but there was a difference in the amount of wax synthesised by the bees to contain the honey. The large-celled combs required 15 % more wax than the small-celled combs. The honey/wax ratio for the 493 foundation was 27:1 and that for the 1 022 foundation 34:1. The honey/wax ratio for wild comb was about 25:1

## Plant pathology/Microbiology

### FUNGI

#### PATHOLOGY

- PB.2521/19/2/1: THE FUNGUS *PHYTOPHTHORA CINNAMOMI* IN THE WESTERN CAPE: HOST RANGE AND DISTRIBUTION OF THE FUNGUS *P. CINNAMOMI*. 1977-1985  
S.L. von Broembsen

The host range and distribution of *Phytophthora cinnamomi* Rands in South Africa but especially in the Western Cape was investigated. *Phytophthora cinnamomi* Rands was recovered from 130 different hosts. Most of these hosts occurred in the south-western Cape Province. The reported host range of the pathogen was extended by 94 new hosts, mainly indigenous flora. Eleven indigenous genera and 80 indigenous species were recorded as hosts for the first time. Approximately half the records were from nurseries, primarily on proteas, pine seedlings, grapevines, ornamentals and avocados.

Because of the high incidence in pine and grapevine nurseries, a warm water treatment was developed to eradicate *P. cinnamomi* from pine seedlings and from dormant grapevines after lifting from nurseries. Control measures have been formulated for forestry and protea nurseries. Proteas and grapevines were the crops from which *P. cinnamomi* was most frequently recorded in this study. The fungus was found to be well distributed throughout the south-western Cape Province on these crops, except in the drier areas. *P. cinnamomi* was also recovered from dying *Pinus radiata* in several plantations and from native vegetation in mountain fynbos areas of this region.

All *P. cinnamomi* isolates recorded from other parts of South Africa were from well-known exotic hosts such as avocado, eucalyptus, pine, and ornamentals, and from cultivated indigenous proteas.



## FUNGI

### PESTS

- PB.2521/19/2/2: THE FUNGUS *PHYTOPHTHORA CINNAMOMI* IN THE WESTERN CAPE: SURVIVAL AND SPREAD OF *P. CINNAMOMI* IN SOIL. 1977-1985  
S.L. von Broembsen

Methods for studying survival and sporulation of *P. cinnamomi* in soil were developed and standardised. These included techniques for axenic production of mycelial mats, chlamydospores and zoospores, devices for exposing these propagules to soil conditions in the laboratory or field and retrieving them, as well as quantitative assays for these propagules and sporangia following exposure.

Eight candidate study sites were evaluated for field factors such as vegetation type, disease level and locality and for laboratory determined soil factors such as physical and chemical properties, moisture capacity, microflora, and influence on *P. cinnamomi* sporangia production, zoospore and chlamydospore germination and infection and saprophytic colonisation.

Three study sites, including two in protea plantations and one in adjacent fynbos, were selected for further study. Results obtained from a one-year field study showed definite seasonal variation in the sporulation patterns of both mating types of *P. cinnamomi* at these study sites. The main factors influencing sporulation were average maximum, minimum soil temperature, rainfall and available soil moisture. Results from laboratory experiments studying factors affecting sporulation in soil under controlled conditions confirmed the results obtained in the field study.

## FUNGI

### PATHOLOGY

- PB.2521/19/2/3: THE FUNGUS *PHYTOPHTHORA CINNAMOMI* IN THE WESTERN CAPE: ROOT AND COLLAR ROT OF CULTIVATED PROTEAS CAUSED BY *P. CINNAMOMI*. 1977-1985  
S.L. von Broembsen

Deaths of proteas grown in the south-western Cape Province for cut flower production, seed production, and breeding were investigated during 1976-1983. *Phytophthora cinnamomi* was isolated from the roots of 63 species of diseased proteas. Disease was often associated with poor drainage. Above-ground symptoms ranged from wilting and rapid death of chlorosis, decline, and eventual death. *P. cinnamomi* was associated most frequently with *Leucospermum* and *Leucadendron* spp. Pathogenicity of *P. cinnamomi* to indigenous proteas in eight (*Leucadendron*, *Leucospermum*, *Protea*, *Aulax*, *Brabeium*, *Mimetes*, *Paranomus*, and *Serruria*) was demonstrated by artificial inoculation.

Phytophthora root rot is a limiting factor in the production of cut flowers from *Leucospermum*, *Leucadendron*, *Serruria* and *Banksia* spp. Prevention remains the most effective method of control. Thus, disease control consists primarily of planting disease-free nursery material on sites with good drainage and no history of disease. Controlling the disease is particularly difficult in the south-western Cape Province because of abundant natural inoculum from infected indigenous flora and infested river water. Development of appropriate fungicide treatments has been largely unsuccessful. Apart from improved chemical control, future advances in control are likely to come from exploitation of genetic resistance available within the Proteaceae and manipulation of cultural practices to reduce disease.

## FUNGI

### PESTS

- PB.2521/19/2/4: THE FUNGUS *PHYTOPHTHORA CINNAMOMI* IN THE WESTERN CAPE: THE OCCURRENCE AND SPREAD OF *P. CINNAMOMI* IN THE RIVERS AND NATURAL WATERS. 1977-1985  
S.L. von Broembsen

The occurrence of *Phytophthora cinnamomi* Rands in rivers of the Western Cape and the implications

## Summaries

of using these rivers as sources of irrigation water was investigated. During surveys conducted in 1977 to 1980, *Phytophthora cinnamomi* was recovered from all major rivers of the south-western Cape Province.

This was the first record of the occurrence of *P. cinnamomi* in these rivers and of its distribution throughout river systems of an entire geographic region. The fungus was found in headwaters draining mountain fynbos catchments of these river systems at concentrations of up to 60 propagules/dm<sup>3</sup>. Also during 1977-1980, most of the protected mountain catchments lying above forestry and agricultural activities were surveyed for dead and dying plants. Isolations were made from these plants for *P. cinnamomi*. The fungus was recorded on 11 genera from five families of native plants at 28 remote, apparently undisturbed sites. No sign of invasion of the native communities by *P. cinnamomi* was observed. *P. cinnamomi* appears to be indigenous to fynbos mountain catchments of this region.

Irrigation water from any river in the area may be infested with this pathogen and should be decontaminated before irrigating susceptible crops, especially nursery material. Several methods of decontaminating irrigation water were tested, including storage in holding dams, filtration, chlorination and combinations of these. Filtration with 5 micron cellulose cartridge filters was the easiest, cheapest and most effective method of eliminating *Phytophthora* spp.

## BACTERIA

### NITROGEN FIXATION

PB.2522/09/1/8: APPLICATION OF NITROGEN-FIXING BACTERIAL INOCULANTS BY MEANS OF IRRIGATION SYSTEMS TO LEGUMES. 1984-1985

J.L. Staphorst

The traditional seed inoculation of legumes is regarded as unpractical by producers planting large amounts of seed during peak times as is commonly practised by commercial producers of peas. The success of so-called "pestigation and fertigation" where metered amounts of pesticides and fertilisers are introduced in the irrigation water, has led to interest in the possibility of applying legume inoculants in a similar way.

Normal seed inoculation applied at the recommended dosage of 250 g peat-based inoculants results in  $2,5 \times 10^8$  *Rhizobium* cells being deposited on each single seed. Where inoculants are applied at the dosage of 250 g inoculant per hectare through the irrigation system, only  $1,25 \times 10^3$  *Rhizobium* cells are in contact with the individual seed. A 200-fold reduction in cells/seed is thus obtained while using 5-6 times the amount of inoculant compared to traditional seed inoculation.

Greenhouse trials with 6 different soils to which increasing amounts of inoculant were applied in the irrigation water, confirmed the availability of relatively small numbers of rhizobia available for nodulation by this method. Only where the inoculant dosage was increased ten-fold was satisfactory nodulation obtained in five of the six soils used. As the minimum area under center pivot irrigation is approximately 30 hectare, a ten-fold inoculant dosage would entail the application of 300 units of inoculant.

Practical problems with sedimentation of the peat-carrier as well as blocking of metering pumps with this amount of inoculant is unavoidable. The extra cost of these relatively large amounts of inoculant needed would also act as a deterrent against the wide-spread use of this method.

Field observation made at adjacent sites where seed inoculation and inoculation by irrigation were applied by a few pea-producers in the Marble Hall district, confirm the results of the greenhouse trials. Only sparse nodulation was obtained where the irrigation method of inoculation was used at the rate of 250 g inoculant per hectare. Nodulation was found to be excellent in adjacent sites where seed inoculation was used.

Inoculation of annual legumes by means of irrigation systems cannot be recommended. It may however be a viable remedial method for perennial legumes where normal seed inoculation has been omitted or found to be unsuccessful. In this case the natural build-up of the *Rhizobium* from the inoculants in the soil can be expected to result in satisfactory nodulation during the following season.

The possibility of applying concentrated liquid inoculants directly to the seed during the planting operation is presently being evaluated by the *Rhizobium* section.

## FOREST AND TIMBER

### PATHOLOGY

PB.2525/19/1/1: ROUTINE INVESTIGATION OF DISEASED FOREST TREES. 1985  
M.J. Wingfield

This research facet was created to provide a service to the forest industry. Foresters who observed



disease problems in their plantations or nurseries could contact the Unit and submit samples for examination. Foresters who submitted samples were generally visited at a later date to facilitate an evaluation of the disease situation. The results obtained under this research facet are recorded with those of the facet "Routine investigation of diseases of forest trees".

This research facet will in future be replaced by subproject PB.2525/19/10: Routine diagnosis of forest tree diseases. This subproject is to be divided into two facets i.e. one dealing with forest tree diseases in the Transvaal and the other with diseases in the Cape Province and Natal. Responsibility for these facets will lie with the Sabie and Stellenbosch forest pathology units, respectively.

## FOREST AND TIMBER

### PATHOLOGY

PB.2525/19/1/2: SURVEY OF DISEASES IN FOREST PLANTATIONS. 1975-1985  
M.J. Wingfield

South Africa has poor resources of indigenous forests and the forestry industry is dependent on pure plantings of exotic trees, especially eucalypts, pines and wattle. These monocultures are extremely vulnerable to diseases. In our major agricultural crops such as wheat and maize, we have experienced severe losses owing to insect pests and diseases. Losses due to diseases in forest crops have however been slight.

A forest pathology programme has been established in South Africa. Forest plantations have been surveyed for diseases. These studies have lead us to recognise the major diseases of forest plantation trees in the country and to establish research priorities for the future.

Root diseases of forest trees are associated with *Armillaria* sp., *Pseudophaeolus baudonii*, *Rhizina undulata*, *Phytophthora cinnamomi*, *Sphaeropsis sapinea* and *Leptographium* spp. Foliage diseases of eucalypts caused by *Aulographina eucalypti* and *Mycosphaerella* spp. have also been found. Fungi infecting pine needles include *Dothistroma septospora*, *Cercoseptoria pinidensiflorae*, *Lophodermium australe* and *Cyclaneusma minus*. Stem diseases of pines and eucalyptus caused by *Sphaeropsis sapinea* and *Cytospora* spp. have also been found.

Detailed research on some diseases not previously recorded in South Africa has been undertaken. *Sphaeropsis sapinea* was found to cause a root disease of pines. This disease results in serious losses to *Pinus elliottii* and *P. taeda* that are stressed. A root disease of pines associated with *Leptographium serpens* has also been identified. This pathogen is carried by insects enhancing its potential for long distance spread.

Many diseases of trees grown in South Africa have not been introduced into the Republic. In addition, the forest industry is relatively young and the full impact of monoculture and progressive soil depletion have not yet been felt. Problems that have arisen have largely been dealt with by planting resistant trees in areas favourable for disease development. Because of the slight impact of tree diseases in the past, forest pathology has been neglected. It is clear that a number of important diseases are causing serious losses in the principal timber growing areas throughout the country. Consequently considerably more attention must be given to forest pathology in future if the industry is to be protected.

## FOREST AND TIMBER

### PATHOLOGY

PB.2525/19/1/3: SURVEY OF DISEASES IN FOREST NURSERIES. 1978-1985  
M.J. Wingfield

Diseases in forest nurseries are responsible for considerable economic losses to the forest industry. These losses necessitated surveys of the disease problems in forest nurseries and research to identify causal agents as well as control strategies.

Many fungi were isolated from diseased seedlings. The major disease of nursery seedlings was damping-off which kills seedlings at an early stage of development. Fungi associated with damping-off of forest tree seedlings included *Fusarium* spp., *Phytophthora* spp., *Rhizoctonia* spp. and *Cylindrocarpon* spp. The most common and virulent of these fungi were *Phytophthora cinnamomi* and *Fusarium oxysporum*.

Strategies to control soil borne pathogens in forest nurseries were developed. Adequate control is achieved by fumigation or steam sterilisation of soil to remove pathogens. In addition, plants must be irrigated with pathogen-free water which can be obtained from springs, by chemical treatment or water

filtration. Nursery beds should be well drained or preferably raised and containerised. Chemical treatment was also shown to enhance germinability of pine and eucalypt seed.

In addition to damping-off diseases, leaf and needle diseases also occurred. Some included *Diplodia pinea* tip blight, terminal crook disease caused by *Colletotrichum acutatum* and eucalyptus leaf spots caused by various pathogens. These diseases are less debilitating than damping-off diseases and can be treated relatively easily with foliar fungicide applications.

## Phytosanitary research and activities

### VIRUSES

#### PATHOLOGY

PB.2531/19/1/1: DETECTION AND IDENTIFICATION OF VIRUS DISEASES OF GRAPEVINE. 1970-1985  
D.J. Engelbrecht

The occurrence and incidence of virus and virus-like diseases in local and imported grapevine sources were determined and improved procedures for their detection investigated.

Graft-transmissible viruses and virus-like diseases detected in local plantings include: grapevine fanleaf, grapevine yellow speckle, grapevine vein necrosis, grapevine leafroll, grapevine corky bark, grapevine stem-grooving (legno riccio), grapevine fleck and grapevine Shiraz decline.

Natural spread of grapevine fanleaf virus (GFLV) was correlated with the presence of *Xiphinema index*. Chemical control of *X. index* by fumigation with D-D failed. An effective double antibody sandwich enzyme-linked immunosorbent assay protocol was developed for the mass indexing of grapevine sources for GFLV.

Grapevine leafroll-free sources were found absent in local propagation material. The disease was shown to be transmitted by the vine mealybug *Planococcus ficus* and natural spread of grapevine leafroll disease was demonstrated in interplanted indicator vines which became totally infected within four seasons. A closterovirus, grapevine virus A (GVA), was found associated with grapevine leafroll disease. Immunosorbent electron microscopy procedures were developed for the rapid detection of GVA in grapevine tissue. GVA appeared to be associated with high particle counts in vines affected by grapevine Shiraz decline.

A high incidence of grapevine stem-grooving disease was demonstrated in local plantings causing severe decline of table grape plantings. GVA was absent in grapevine stem-grooving sources free from grapevine leafroll disease.

Seventy-six per cent of grapevine importations over the last 10 years were infected with one or more endemic graft-transmissible disease. More than 80% of the infected vines carried either grapevine leafroll disease or grapevine stem-grooving disease or both.

### VIRUSES

#### PATHOLOGY

PB.2531/19/1/2: ELIMINATION OF VIRUS DISEASES IN THE GRAPEVINE. 1970-1985  
Roleen Human and D.J. Engelbrecht

Total infection of local grapevine sources with one or more graft-transmissible virus-like diseases necessitated the evaluation of existing virus elimination procedures.

The standard heat treatment at 38 °C for periods of 150-300 days followed by rooting or grafting of shoot tips of 5-15 mm gave poor results. Less than 1% of the explants produced in this manner were still free from grapevine leaf-roll disease after 5 years. Only grapevine fanleaf virus could be eliminated.

An *in vitro* method was developed to grow healthy shoot apex cultures from diseased vines. Mother plants were kept at 34/28 °C (16 h photo period/8 h dark period) or 38/34 °C for 8-12 weeks and meristem tips, consisting of 1-3 leaf primordia and 0,1-0,8 mm in size were collected at regular intervals and grown on the standard Murashige and Skoog medium (*Physiol. Pl.* 15, 473-497, 1962). Excellent shoot initiation was obtained with half-strength salt and full strength vitamins in the medium which was solidified with agar and supplemented with 1 mg/ℓ 6-benzyladenine (BA), 0,1 mg/ℓ naphthalene acetic acid (NAA) and 3% sucrose. Optimum shoot elongation was obtained with the initiation medium at full strength. The addition of BA and



NAA to the Murashige and Skoog medium was not required to obtain rooting provided the shoots were kept in darkness for c. 10 days following transfer to the hormone-free medium. Optimum rooting was however, achieved in half-strength salts and full-strength vitamins in the medium.

Preliminary indexing results suggest that heat-stable virus-like diseases such as grapevine corky bark, grapevine leafroll and grapevine yellow speckle can effectively be eliminated from vines by growing apical meristems of less than 0.4 mm, containing 1-2 leaf primordia. Furthermore, pre-treatment of mother plants appears not to be significant in freeing apical meristems of heat-stable grapevine leafroll disease. In the first season of indexing only 7 out of 189 explants, obtained from virus-infected mother plants tested positive for virus-like diseases.

## VIRUSES

### PATHOLOGY

- PB.2531/19/1/4: EVALUATION AND USE OF INDICATOR PLANTS FOR THE DETECTION AND IDENTIFICATION OF VIRUS DISEASES IN POME FRUIT. 1982-1985  
Van Z. Siebert

The erratic performance of a range of international woody indicators for the detection of virus and virus-like diseases of pome fruits under field conditions at Stellenbosch, prompted a study under milder climatic conditions at Grabouw and in temperature-controlled glasshouse compartments. The following results were obtained.

1. Field studies - *Malus pumila* cv. Lord Lambourne consistently detected apple mosaic disease. In addition, a local apple seedling selection (RSA4A) was equally effective but showing a severe reaction with isolates causing only mild symptoms on Lord Lambourne. The latter cultivar is prone to delayed foliation and could therefore be replaced with the RSA4A seedling selection.

*M. pumila* cv. Red Gravenstein was superior in the detection of isolates of apple flat limb disease and will replace the internationally recognised indicator *M. pumila* cv. Stahlz Prince under local conditions.

*Pyronia veitchii* produced trunk symptoms when infected with apple stem grooving and apple stem pitting diseases under local conditions. These findings are incongruous with those reported from abroad, suggesting immunity (hypersensitivity) of the indicator to apple stem grooving disease.

2. Glasshouse studies - temperature conditions under which indicators were grown following indexing with latent virus and virus-like diseases were found decisive in symptom expression. For optimum detection of the so-called "apple latents" in pome fruits *P. veitchii* and *M. platycarpa* were maintained at 20/22 °C; for Spy 227 the optimum was 24/26 °C.

It is concluded that the performance of a woody indicator greatly depends on environmental factors of which temperature appear to be a significant parameter. Internationally recognised indicators must therefore be carefully evaluated before introduction into the local indexing programme.

## VIRUSES

### PATHOLOGY

- PB.2531/19/1/5: DEVELOPMENT AND APPLICATION OF IMMUNOLOGICAL PROCEDURES FOR THE DETECTION AND IDENTIFICATION OF VIRUSES OF POME AND STONE FRUITS. 1982-1985  
J. Thatcher and G.G.F. Kasdorf

Studies were undertaken to prepare antisera to some economically important viruses found in local pome and stone fruit orchards and to develop rapid immunological procedures for their mass detection and identification. The following results were obtained:

1. Apple stem grooving virus (ASGV) - an improved purification procedure, following propagation in *Nicotiana clevelandii* Gray (a latent host), by replacement of sucrose density gradient centrifugation with gel filtration on a column of Sephadex 4B enabled the production of an antiserum (titre 1/128) to a local isolate. All attempts failed to develop an appropriate enzyme-linked immunosorbent assay (ELISA) test procedure for ASGV.

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2. Apple chlorotic leafspot virus (CLSV) - studies showed that the addition of 10% bentonite solution (50 mg/ml) to the standard extraction buffer was essential to detect the presence of virus by the double antibody sandwich (DAS) ELISA procedure in *Pyronia veitchii* and quince leaf extracts.
3. Prune dwarf virus (PDV) - an antiserum (titre 1/64) to a local isolate (N49/6) was prepared. Stabilisation of the purified preparation was greatly enhanced by the addition of 0,03 M Na<sub>2</sub>EDTA. Immunosorbent electron microscopy followed by decoration confirmed the similarity of N49/6 to the American type strain of PDV. ELISA studies has not yet been attempted with the antiserum to the local strain of PDV.
4. *Prunus* necrotic ringspot virus (PNRSV) serotypes - an antiserum (titre 1/1024) to an *intermediate* serotype of PNRSV readily detected homologous virus in hop by DAS ELISA but poorly the heterologous PNRSV in woody hosts and the apple mosaic virus (AMV) serotype of PNRSV in a local apple seedling source. The use of a monospecific antiserum for routine screening of trees for PNRSV serotypes by DAS ELISA therefore appears to be ruled out.

Although antisera of acceptable titres had been produced appropriate immunological detection procedures are still lacking in some instances. This problem will require urgent attention in future investigations.

## VIRUSES

### PATHOLOGY

PB.2531/19/1/6: ELIMINATION OF VIRUS DISEASES OF POME AND STONE FRUITS.  
1982-1985

Roleen Human, Ursula Schwerdtfeger and Van Z. Siebert

*In vitro* procedures were developed to eliminate heat-stable virus and virus-like diseases in commercial pome and stone fruit cultivars. For this purpose meristem tips of 0,4-0,8 mm were grown on various culture media. The following results were obtained:

Apple and pear - best results were obtained using three variations of a standard Murashige and Skoog medium (*Physiol. Pl.* 15, 473-497, 1962) without the addition of auxins, e.g. indole-3-butyric acid (IBA) and naphthaleneacetic acid (NAA):

- (a) full strength salts; full strength vitamins; 1 mg/l 6-benzyladenine (BA); 3% sucrose and 0,6% agar.
- (b) half strength salts; full strength vitamins; 1 mg/l BA; 3% sucrose and 0,6% agar.
- (c) half strength salts; full strength vitamins; 3% sucrose and 0,6% agar.

All three media promoted shoot initiation and media (a) and (b) shoot elongation (proliferation), but rooting failed despite the addition of auxins. Heat-stable latent apple and pear viruses, e.g. apple chlorotic leaf spot virus, apple stem grooving virus and apple stem pitting virus were successfully eliminated by this procedure.

Stone fruit cultivars - the standard Murashige and Skoog medium (a) with the addition of 0,1 mg NAA gave good results with plum cultivars for shoot initiation and proliferation. Successful rooting of plum cultivars was furthermore obtained in the absence of BA. Almond meristems were successfully grown on the standard medium (a) using 0,1 mg BA plus 0,1 mg IBA for the initiation stage, but 1,0 mg BA for the proliferation stage. Best rooting was obtained with the medium of Rugini (*Plant Sci. Letters* 28, 273-281, 1982). Latent stone fruit viruses, e.g. *Prunus* necrotic ringspot and prune dwarf were successfully eliminated in both plum and almond.

Cherry cultivars - the standard medium of Kornkamhaeng (Dr. Agr. thesis Institut für Obstbau und Gemüsebau der Rheinischen Friedrich-Wilhelms-Universität, Bonn, 1983) was used for the *in vitro* cultivation of cherry meristem tips.

## VIRUSES

### PATHOLOGY

PB.2531/19/1/7: DETECTION AND IDENTIFICATION OF VIRUS DISEASES IN POME  
FRUIT. 1983-1985

Van Z. Siebert and F.A. Maré

The incidence of virus and virus-like diseases in imported and local pome fruit sources was recorded to



assess the value of present plant introduction procedures and virus status of commercial plantings. The following results were obtained:

1. No exotic virus or virus-like diseases were detected in imported plant units over a period of two years. However, 75 % of all importations indexed carried one or more endemic virus or virus-like disease. Similarly, 80 % of all local sources indexed were found infected.
2. Endemic virus diseases recorded on apple and pear included the following:
  - Apple: Apple mosaic, apple stem pitting, apple stem grooving, apple chlorotic leafspot, apple epinasty and decline, apple rubbery wood, apple flat limb, apple russet ring, apple ringspot, apple green dimple and apple green crinkle. Apple green dimple was recorded for the first time in local apple cultivars, Granny Smith, Starking and Starkrimson. The incidence of the virus combination of apple stem grooving/apple chlorotic leafspot/apple epinasty and decline was exceedingly high suggesting some form of natural spread or near total infection of nursery stock.
  - Pear: Pear vein yellows, quince stunt, quince yellow blotch, apple chlorotic leafspot, apple stem grooving, apple rubbery wood, apple flat limb, apple stem pitting, pear stony pit and pear necrotic spot. The latter disease and quince yellow blotch were recorded for the first time in local pear plantings. Apple stem grooving virus was found to be associated with a wide-spread decline of pear orchards growing on sensitive Bon Chretien seedling rootstock. Apple stem grooving virus was detected in 50-90 % of active declining Bon Chretien, Forelle and Packham's Triumph orchards. Past use of infected rootstock may have contributed to the high incidence of apple stem grooving virus.

It is concluded that screening of introductions and the provision of healthy planting material are essential to the local pome fruit industry.

## BACTERIA

### PATHOLOGY

PB.2532/19/1/1: CONTROL OF CROWN GALL BACTERIA BY CHEMICAL AND PHYSICAL METHODS. 1980-1985  
F.G.H. van Zyl

Various methods of chemical and physical control were employed in either combating the bacteria or the tumours on plants. These methods, if successful, had to be practical and cheap.

Of all the chemicals investigated so far not one, proved to be successful. Only Gallex caused a slight regression of tumorous tissue, but proved to be phytotoxic to normal plant tissue. It was found by the Oenological and Viticultural Research Institute that Gallex was unsuccessful in treating crown gall on grapevine. Control chemicals should be aimed at the killing of the bacteria in soils, or selectively destroying the t-DNA containing plant cells.

Various methods of physical control were also tested, but again very few proved promising. The cheap and successful warm water treatment proved unsuccessful in both killing the bacteria and controlling the disease. Soil solarisation appears to be a promising control method especially to nurserymen that utilise the same soils year after year.

Certain cultivation practices were observed to control the disease or keep it from spreading. These practices included the use of borehole water for irrigation, drop irrigation systems, sterilised potting soil, sterilised working surfaces, sterilised impliments, selected disease-free scion wood and rootstock material and the use of effective antagonistic control strains.

One of the biggest pitfalls in selection of disease-free material is latent infections that cannot be detected. Interesting also was the fact that the crown gall disease does not occur in the Boland, but is apparent in nearly all other grapevine cultivation areas. The reason for this phenomenon is still unknown and will be investigated in the future.

## BACTERIA

### PATHOLOGY

PB.2532/19/1/2: BIOLOGICAL CONTROL OF CROWN GALL. 1980-1985  
F.G.H. van Zyl

From the results obtained it was clear that the agrocins produced by control strains do not play a very

## Summaries

important role in biological control of crown gall, and more importance will be placed on glasshouse and field trial results in the future.

Ever since the application of *A. radiobacter* K84 in the stone fruit industry, none or very little crown gall infections were reported. Before *A. radiobacter* K84 became available large losses occurred owing to this disease. In commercial nursery material *Chrysanthemum* (marguerites), especially cultivars Double Yellow and Snowflake, appear to be very susceptible to crown gall. A non-pathogenic *A. tumefaciens* strain D286 controlled this disease to a large extent in a recent field trial. The application of *A. radiobacter* K84 in this case was unsuccessful. The biggest problem now appears to be the spreading of crown gall infected grapevine material from grapevine nurseries to other cultivation areas in the country.

Neither *A. radiobacter* K84 nor *A. tumefaciens* D286 successfully controls this disease on grapevine. Also, the grapevine pathogens are very host specific and does not infect other plants. Recently, two promising *A. radiobacter* non-pathogenic biotype-3 strains produced very promising results as possible control strains for crown gall on grapevine. Further field evaluations will still have to be performed to evaluate both these strains.

## BACTERIA

### PATHOLOGY

PB.2532/19/1/3: INCIDENCE OF CROWN GALL BACTERIA ON DIFFERENT HOSTS.  
1980-1985

F.G.H. van Zyl

A survey of the different biotypes of *Agrobacterium tumefaciens* was conducted in all areas where the crown gall disease was apparent. The geographic distribution of this disease was also investigated, which host plants were affected, and to what degree the disease affected these host plants.

All three biotypes of the crown gall pathogen *A. tumefaciens* occurs in South Africa. Biotype-1 strains mostly infected ornamentals like marguerites, biotype-2 strains mostly stone fruit, whereas biotype-3 pathogens were only isolated from infected grapevine. A large number of non-pathogenic biotype-1 strains were also isolated from grapevine in the Western Cape.

It appears as if crown gall has a wide-spread geographical distribution and was found in nurseries all over South Africa. Crown gall on grapevine has recently shown a marked increase in certain areas like Northern Cape, North-western Cape and Nylstroom, Transvaal. Nearly all material planted in these areas showing infection was obtained from grapevine nurseries in Wellington, Western Cape.

As crown gall symptoms do not occur on grapevines in the Boland, the spreading of this disease was not considered very important, until it was recently found how wide-spread this disease already was.

## FUNGI

### PATHOLOGY

PB.2533/19/1/4: CONTROL OF PATHOGENIC FUNGI IN WOUNDS ON NURSERY  
MATERIAL. 1983-1985

S.H. Koch

Nineteen different wound treatment (WTS) were evaluated for their effect on callus formation and on wood and bark discoloration on cuttings of five different rootstocks [apple (M793), pear (BP1), quince (A-EMLA), cherry (Mazzard F12/1) and prune (Marianna)]. None of the WTS evaluated for callus formation and wood and bark discoloration, had the same effect on the different rootstocks. All these WTS inhibited the growth of *Schizophyllum commune*, *Eutypa armeniacae* and *Chondrostereum purpureum*. Older WTS tend to loose their effect on fungal growth.

A technique was developed to evaluate the effect of WTS on penetration of wound pathogenic fungi, by using WTS on nylon mesh. The plastic basis of WTS as such gave no resistance to penetration of the tested fungi. A simulation of 240 mm rainfall applied to WTS on nylon mesh had no effect on penetration of tested fungi.

Nuclear material, which showed die-back symptoms, was collected at the Quarantine Station, Stellenbosch. Isolations were made from either wood, pith or bark tissue of plants with die-back symptoms. Representative cultures of all fungi isolated were sent to the Mycological Herbarium, Pretoria and Dr W.F.O. Marasas, MRC, Tygerberg for final identification.



## Weed research

### PESTICIDES

#### CHEMISTRY

PB.2552/53/1/3: NEMATOCIDES IN WINE GRAPES. 1982-1984  
Marelie Krause

Residues of the toxic metabolite (sulphone) of aldicarb (2-methyl-2-(methylthio) propionaldehyde-O-methylcarbamoyloxime) and fenamiphos (ethyl 4-methylthio-*m*-tolyl isopropylphosphoramidate) in the roots, soil, leaves and fruit from vineyards, were determined with a gas chromatograph equipped with packed columns.

Aldicarb at 5 kg/ha and fenamiphos at 20 kg/ha were applied either broadcast or in 2-cm bands on each side of the rows of vines. Soil samples taken one day after application contained high concentrations of aldicarb sulphone (AS) in the 0-30 cm layer, and six days later this had leached to the 30-60 cm layer. Twenty-eight days after application no AS was present in any soil samples at the depths sampled. The fenamiphos sulphone (FS) in the soil leached rapidly into the 30-60 cm layer one day after application. Then the amount decreased slowly, possibly because of migration back to the dry upper layer with soil moisture, as suggested by a simultaneous increase in concentration in the 0-30 cm layer during the same period. On day 28 the FS concentration in the 30-60 cm layer was again higher, possibly because of rain (17,9 mm) that had fallen on day 21.

The AS concentration in the leaf samples taken from the broadcast application plots reached very high levels 28 and 42 days after application, but fell to only 0,36 mg/kg on day 112. Band application in contrast to broadcast application gave rise to a lower maximum leaf concentration of AS. The FS in leaves reached a maximum of 1,45 mg/kg on day 28 in the broadcast application plots and the band application gave rise to a higher maximum leaf concentration of FS than the broadcast application.

In spite of the concentration of AS and FS in the soil, all fruit samples taken contained less than 0,01 mg/kg AS and less than 0,02 mg/kg FS at harvesting. Root samples contained high residue concentrations of AS as well as FS one day after application, but no further samples were taken because of possible damage to the vines. The control samples were without any AS or FS residues.

## ANIMAL PRODUCTION PROMOTION

### ANIMAL PRODUCTION AND ANIMAL PRODUCTS RESEARCH

#### Animal products

##### MILK

#### MICROBIOLOGY

- VS.3123/08/1/8: RAPID TESTS FOR ESTIMATING THE PSYCHROTROPHIC COUNT OF MILK. 1984-1985  
H. Lück

The rapid psychrotrophic count test (21 °C/25 h) was compared with the standard psychrotrophic count test (7 °C/240 h). The rapid method gives an estimation of the psychrotrophic count ( $r = 0.89$ ; 85 samples) which can, however, be significantly higher than the standard psychrotrophic count (especially when the psychrotrophic bacteria only form a part of the total flora).

The 21 °C/25 h plates, after having been counted, can be used for the determination of the total bacterial count ( $TC_M$ ) after an additional incubation at 30 °C for 23 h. No significant difference between log  $TC_M$  and log standard plate count was found.

#### Supporting animal research

##### ANIMALS

#### NUTRITION

- VS.3133/05/1/2: FEED INTAKE IN THE NUTRITION OF FARM ANIMALS: FEED MIXTURES. 1979-1983  
J.P. Campher

In a study designed to quantify voluntary intake in mixed diets it was found that a statistically significant second-order polynomial relationship could be fitted with dry matter intake (g/kg/day) and % concentrate in the diet as dependant and independant variables, respectively when heifers were fed on such diets.

In the case of the wethers, however, this second-order polynomial curve was not found. The reason for this is uncertain, but may be linked to the fact that the *Eragrostis curvula* hay was hammer-milled through a 50 mm screen. This resulted in a physical limitation to intake even at very high levels of concentrate.

A second study with similar wethers was conducted. In this instance pelleted lucerne (*Medicago sativa*) was used as roughage source. This system assured that the point where chemo- and thermostatic controls of intake take over, were surpassed. A statistically significant second-order polynomial curve was thus found. It was, therefore, concluded that both physical limitation, as well as acceptability, affected the intake of the *Eragrostis curvula*-based diets.

##### ANIMALS

#### NUTRITION

- VS.3133/05/1/4: CONTROL OF FEED INTAKE AS AFFECTED BY PREVIOUS TREATMENT  
J.P. Pienaar, H.S. Hofmeyr and G.L. Whiteford

An experiment was conducted with eighteen rumen cannulated sheep fed on a chopped lucerne diet.



## Summaries

Previous level of intake significantly influenced the level at which sheep initially established voluntary feed intake. This difference had disappeared after three weeks on an *ad lib.* intake.

Perturbation analysis of the results of the chopped lucerne diet and a high concentrate diet showed that sheep at low intakes, accommodated increased intakes mainly by increasing the rate constant which describes the fermentation and outflow of fermentable organic matter (OM). This rate constant became less important as intake was increased and was progressively replaced by rumen fill, which accommodated 65 % of increased intake at 1 400 g of OM intake (Table 1).

TABLE 1 - Perturbation analysis of the results of the intake of a chopped lucerne diet and a high concentrate diet

| OM intake | Concentrate diet      |                                     |                                                               |
|-----------|-----------------------|-------------------------------------|---------------------------------------------------------------|
|           | Increased fill<br>(Z) | Increased outflow<br>( $\gamma_2$ ) | Increased fermentation & outflow<br>( $\gamma_1 + \gamma_0$ ) |
| 400       | 35                    | 10                                  | 55                                                            |
| 650       | 45                    | 15                                  | 40                                                            |
| 900       | 52                    | 19                                  | 29                                                            |
| 1 150     | 60                    | 20                                  | 20                                                            |
| 1 400     | 65                    | 20                                  | 15                                                            |
|           | Roughage diet         |                                     |                                                               |
|           | Increased fill<br>(Z) | Increased outflow<br>( $\gamma_2$ ) | Increased fermentation & outflow<br>( $\gamma_1 + \gamma_0$ ) |
| 400       | 35                    | 20                                  | 45                                                            |
| 650       | 50                    | 30                                  | 20                                                            |
| 900       | 58                    | 37                                  | 5                                                             |
| 1 150     | 62                    | 38                                  | 0                                                             |
| 1 400     | 65                    | 40                                  | -5                                                            |

## ANIMALS

### NUTRITION

VS.3133/05/1/5:

A COMPARISON OF METHODS USED TO ESTIMATE A RATE CONSTANT FOR OUTFLOW FROM THE RUMEN. 1981-1983

J.P. Pienaar, C.Z. Roux and B. van Zyl

An experiment was conducted with 4 sheep fed a lucerne-based diet. These sheep were fitted with large rumen cannulae so that their rumens may be emptied to estimate rate constants for outflow of non-fermentable organic matter according to the "steady state" method.

A comparison of a "steady state" method with a number of marker based methods, together with autoregression analysis, showed that estimates of rate constants for outflow from the rumen should include a time-dependant phase together with a first-order estimate shown in Table 1 under "single dose marker faecal appearance". A simple first-order, two-compartment, flow analysis where the time-dependant phase was described as being the second compartment and was calculated as being outside the rumen, gave results which underestimated rumen residence time as shown in Table 1 under single dose marker declining slope method.

TABLE 1 - Different estimates of the rate constants for outflow from the rumen (fraction per day)

| Method used                          | Sheep number |       |       |       | Mean $\pm$ SD     |
|--------------------------------------|--------------|-------|-------|-------|-------------------|
|                                      | 1            | 3     | 5     | 7     |                   |
| Steady state                         | 0,821        | 0,880 | 0,939 | 0,810 | 0,863 $\pm$ 0,060 |
| Single dose marker declining slope   | 1,176        | 1,420 | 1,320 | 1,152 | 1,267 $\pm$ 0,126 |
| Single dose marker autoregression    | 1,198        | 1,132 | 1,432 | 1,014 | 1,194 $\pm$ 0,176 |
| Single dose marker total tract       | 0,679        | 0,715 | 0,640 | 0,652 | 0,672 $\pm$ 0,033 |
| Single dose marker faecal appearance | 0,878        | 0,939 | 0,813 | 0,834 | 0,866 $\pm$ 0,056 |

## ANIMALS

## NUTRITION

VS.3133/05/4/2: ENSILING OF BROILER LITTER FOR UTILISATION BY RUMINANTS.  
1979-1983  
P.H. Henning

Broiler litter (BL) was ensiled after reconstitution to 60 % dry matter either alone (treatment B1) or with formic acid [3 % on a dry matter (DM) basis, treatment B2] or maize meal (one part BL and two parts maize meal - DM basis, treatment B3) or molasses (two parts BL and one part molasses - DM basis, treatment B4).

Dry BL was heavily contaminated with pathogenic strains of *Proteus*, *Streptococcus*, *Salmonella* and *Escherichia coli*. The silages, opened after 120 days, were all well preserved (no signs of mould, rotting or unacceptable odours) and were found to be free of any of the above-mentioned pathogens.

All BL silages as well as untreated BL (treatment B5), were incorporated into complete diets based on maize meal and containing 33 % BL. All diets, including a control diet (treatment K) based on *Eragrostis curvula* and maize meal, were isonitrogenous and isocaloric (13,5 % crude protein and 12,25 MJ ME kg<sup>-1</sup> DM).

Thirty Merino wethers (approximately 30 kg live mass) were randomly divided into six groups of five each. Every diet was fed *ad lib.* to one of the experimental groups for a period of 60 days.

The results in Table 1 were obtained:

TABLE 1 - Diets fed to the experimental groups for 60 days

| Dietary treatment              | K                  | B1                  | B2                  | B3                  | B4                 | B5                 |
|--------------------------------|--------------------|---------------------|---------------------|---------------------|--------------------|--------------------|
| Average daily DM intake (g)    | 1 039 <sup>a</sup> | 1 451 <sup>ab</sup> | 1 251 <sup>ab</sup> | 1 429 <sup>ab</sup> | 1 648 <sup>b</sup> | 1 511 <sup>b</sup> |
| Average daily gain (g)         | 75 <sup>a</sup>    | 161 <sup>ab</sup>   | 154 <sup>ab</sup>   | 198 <sup>b</sup>    | 205 <sup>b</sup>   | 226 <sup>b</sup>   |
| Efficiency of feed utilisation | 19,0 <sup>c</sup>  | 9,1 <sup>d</sup>    | 8,6 <sup>d</sup>    | 7,5 <sup>d</sup>    | 8,6 <sup>d</sup>   | 7,1 <sup>d</sup>   |

a, b: Values with different scripts differ significantly ( $P < 0,01$ )

c, d: Values with different scripts differ significantly ( $P < 0,05$ )

The following can be concluded from the results:

- Ensiling of BL can successfully eliminate pathogenic organisms.
- Both ensiled and dry BL are acceptable for ruminants and can be successfully used for providing nutrients, particularly nitrogen, in ruminant diets.
- Presence of pathogenic organisms in BL does not necessarily prohibit its use in ruminant diets, although this statement should be interpreted with care.

## ANIMALS

## NUTRITION

VS.3133/05/4/3: THE NUTRITIVE VALUE OF DIFFERENT PORTIONS OF THE MAIZE PLANT AND THEIR RESPONSE TO NaOH TREATMENT. 1979-1983  
P.H. Henning and D.G. Steyn

Changes in composition and digestibility with time and response to NaOH treatment of different portions of the maize plant, were investigated. Mature dry maize plants cut at 3 consecutive occasions, 4 weeks apart, were divided into stalks, cobs, plant leaves, cob leaves, kernels and plumes. Corresponding portions for each cutting date were combined, mass-measured and treated with 60 g NaOH/kg plant material. Material from different cutting dates was treated separately.

Dry matter yield per plant declined by 25 % from first to second cut mainly due to wind and bird damage. The ratio of plant portions changed with time and is probably due to differential resistance to weathering, leading to an increase in proportion of less digestible stalks and a decrease in more digestible



plant and cob leaves. *In vitro* organic matter digestibility of plant portions differed, leading to differences in response to NaOH treatment between portions.

It was concluded that factors influencing the proportion of maize plant portions will affect the response to NaOH treatment because of differences in initial digestibility between plant portions. This would result in differences in extent of improvement following NaOH treatment.

## VETERINARY RESEARCH

### Pathological investigations

#### PATHOLOGICAL INVESTIGATIONS

##### ANATOMY

OP.3211/02/1/2: QUANTITATIVE MEASUREMENTS OF THE NORMAL OVINE HEART.  
1982  
S.J. Newsholme

Hearts from 60 Merino sheep of known age, sex and live mass and with no known history of disease, were collected and fixed in 10% buffered formalin. Systematic light microscopical examination did not indicate that any of the hearts was abnormal. The mass of various parts of the hearts, the length of the hearts and the diameters of the heart valves were measured.

The mass measurements and, to a lesser degree, the lengths of the hearts varied considerably, but the ratio of the mass of the left ventricle plus ventricular septum divided by the right ventricular free wall mass (LV+S/RV) was remarkably stable.

#### PATHOLOGICAL INVESTIGATIONS

##### PATHOLOGY

OP.3211/19/2/5: PATHOLOGICAL INVESTIGATIONS OF *MATRICARIA NIGELLIFOLIA* TOXICOSIS. 1983  
S.J. Newsholme

Dried, milled, *M. nigellifolia* was dosed to 6 steers. Clinical signs of pushing disease appeared abruptly in 5 of the steers after a latent period that varied from 16-44 days. The lowest total dose of plant that proved toxic was 10 g/kg. The length of the latent period appeared to be inversely related to the total dose. Encephalitis, which was characterised by predominantly perivascular microgliosis, perivascular lymphocytic infiltrates and reactive changes in astrocytes, was present in all five of the affected steers, and was similar to that seen in brains from field cases of pushing disease.

Specimens of brain tissue were collected at necropsy from 4 of these steers, fixed in buffered glutaraldehyde and processed for electron microscopy. Examination of thin sections showed that the tissue was poorly preserved and the perivascular zones were distorted by shrinkage artefacts. These sections added no new information about the nature of the lesion.

Plants from the same batch used on the cattle were dosed to two 5-month-old Merino wethers. Each sheep received a total dose of 370 g/kg of the milled, dried plant. Neither of the sheep developed clinical disease after the trial period of 60 days, and necropsies revealed no macro- or microscopical lesions. The results of this trial have been submitted for publication.

The results of the dosing trial with cattle indicate that the cerebral lesion is sufficiently consistent and distinctive to be useful in establishing a diagnosis of pushing disease by light microscopy. The perivascular distribution of microgliosis suggests that the site of toxic insult is the cerebral vasculature.

## Food hygiene

### ANIMAL FOODS

#### PATHOLOGY

- OP.3221/19/1/4: ELECTRON MICROSCOPIC OBSERVATIONS IN THE LUMINAL SURFACE OF TEAT CUP LINERS OF MILKING MACHINES USED UNDER SOUTH AFRICAN CONDITIONS. 1982-1984  
W.H. Giesecke

An investigation undertaken with the aid of scanning electron microscopy (SEM) on new and used teat cup liners revealed the generally poor quality of luminal surfaces. Even those of the brand new distributor controls showed significant faults in the evenness and continuity of the liner surface. A hundred and 500 milkings apparently tend to aggravate faults like cracks, pores, grooves and pits, because of the general brittleness of some of the teat cup liners.

The poor quality of the liners investigated raises various questions about the method of distribution of teat cup liners and serious concern about the role they play in predisposing bovine udders to mastitogenic infections, spreading mastitis, affecting the production and quality of milk, increasing the cost of milk production and reducing profits of dairy farming.

## Internal parasites

### HELMINTHS

#### PESTS

- OP.3241/20/2/2: HELMINTHS: EFFECT OF IRRADIATION ON THE VIABILITY OF MEASLES IN CATTLE. 1972-1985  
A.J.M. Verster

Previously no animal model was available for investigating, *in vivo*, the effect of factors like irradiation on the viability of cysticerci of *Taenia solium* and *T. saginata*.

In various trials an animal model (immuno-suppressed hamsters) was firstly developed and tested and then used for evaluating the effect of various doses of irradiation on the viability of cysticerci.

#### Results

##### *Animal model*

The golden hamster was found to be suitable host for testing the development of cysticerci. Injections of immuno suppressive drugs, viz methylprednisolone acetate and betamethasone disodium phosphate increased the susceptibility of the hamsters to infestation with the *Taenia* spp. The susceptibility was further increased by treatment with anti-lymphocytic serum (ALS) or whole body irradiation.

Although the worms develop to sexual maturity they do not produce eggs.

##### *The effect of gamma radiation on the cysticerci*

Cysticerci of *T. solium* and *T. saginata* were exposed to gamma radiation in doses varying from 0,2-1,4 kGy. Radiation had an adverse effect on the ability of the cysticerci to evaginate *in vitro* after a time lag of 9 days in *T. solium* and after 6 days in *T. saginata*. Some cysticerci of *T. solium* treated with low doses (0,2-0,8 kGy) evaginated 24 days after treatment but no *T. saginata* cysticerci evaginated after 15 days.

Cysticerci exposed to radiation doses of 0,2-1,2 kGy are as infective to golden hamsters as untreated cysticerci. Cestodes resulting from irradiated cysticerci, however, cannot maintain themselves indefinitely and are excreted or digested from Day + 12 onwards. Such tapeworms do not grow but are resorbed and finally consists of only a scolex. It appears that radiation inhibits the ability of the cells to divide and the cells do not recover from this treatment.



Carcases lightly infested with cysticercosis could be rendered fit for human consumption by exposure to low doses (0,2-0,6 kGy) of gamma radiation.

The main advantage of the new system of testing is that now, for the first time it is possible to determine the ability of the cysticerci to develop after various treatments aimed at rendering meat safe for human consumption. Previously, only the ability of the cysticerci to evaginate could be tested, and the doses of radiation required to achieve this are so high, that it is firstly too costly for routine use, and also the radiation has a deleterious effect on the physical qualities of the meat. It is important to realise that cysticerci that can evaginate, are not necessarily able to infest a host, or maintain themselves in the host.

## Reproduction investigations

### INFERTILITY

#### PATHOLOGY

OP.3251/19/2/4: INFERTILITY: IMMUNE COMPETENCE OF THE UROGENITAL SYSTEM OF THE SHEEP AGAINST *ACTINOBACILLUS SEMINIS*. 1979-1985  
B.C. Jansen

According to several reports in the literature, *Histophilus ovis* exerts its pathogenic effects in sheep by invading the body tissues. In addition to isolations from other organs, the organism has been isolated from cases of epididymitis in rams in various countries, including South Africa. Its implication as a cause of infertility in rams led to a study of naturally acquired immunity to *H. ovis* in sheep and to an investigation of the immunity produced in experimental animals by injecting an antigen prepared from the organism in combination with different adjuvants.

It was demonstrated that skin wound infection with *H. ovis*, for example after Mule's operation, shearing, castration or docking, elicits an immune response which can protect a ram against a challenge injection of the same organism into its epididymis.

Rams could also be immunised against an infection of their genitalia by *H. ovis*. An alum precipitated antigen and an antigen plus Freund's complete adjuvant proved equally effective. It was shown that cell-mediated immunity, as evidenced by tests for lymphocyte transformation, the presence of a macrophage migration inhibition factor and delayed hypersensitivity skin reaction, did not play a role in the resistance, nor did specific IgG antibodies have any protective influence. It was shown that neutrophils play a cardinal role in the immunity against *H. ovis* infection in so far as they phagocytose and destroy the organisms and are attracted to them by chemotaxis in immune animals.

## Entomological investigations

### EXTERNAL PARASITES

#### PATHOLOGY

OP.3261/19/1/4: THE IMMUNISATION OF CALVES AGAINST HEARTWATER. 1983-1984  
J.L. du Plessis

Cattle vaccinated as calves with *Cowdria ruminantium*-infected tick stabilate, were challenged 6, 12 and 24 months later. In the absence of tick challenge, vaccination of calves induced a partial immunity against subsequent challenge at 12 and 24 months. In animals exposed to ticks, the resistance was no better than that of the control, unvaccinated cattle. When they were challenged at 6 months of age, there was no difference between vaccinated and unvaccinated calves, either in the absence or presence of tick challenge, and all the animals manifested a high degree of natural resistance. This study, therefore, suggests that the value of vaccinating Afrikaner-cross calves in heartwater- endemic areas should be further investigated.

The indirect fluorescent antibody (IFA) test proved to be a valuable means of monitoring the serological response of vaccinated animals and detecting the sero-conversion of animals exposed to tick infection. On one hand there was good correlation between the febrile reaction and the results of the IFA test on the sera of vaccinated and control cattle challenged with the heartwater agent, in that all sero-positive

## Summaries

animals were resistant to challenge. On the other hand, though, a considerable percentage of the animals that were serologically negative were also resistant to challenge.

### Virus investigations

#### VIRUSES

##### PATHOLOGY

OP.3271/19/2/1: COMPARISON OF RIFT VALLEY FEVER VIRUS VACCINES. 1971-1985  
B.J.H. Barnard

In a study of the response in cattle to a live and an inactivated Rift Valley Fever (RVF) vaccine prepared from cell cultures infected with RVF virus, the effects of varying doses and combinations of these vaccines were compared. The antibody response to a primary injection of either vaccines was poor when measured by the serum virus neutralisation test (SVN) and the haemagglutination-inhibition test (HI), but a booster dose of inactivated vaccine evoked a good anamnestic response in cattle previously injected with either of these vaccines. Cattle vaccinated with the live vaccine but negative to the SVN or the HI for RVF, were immune when challenged with a virulent RVF virus isolated from a cow during 1974.

#### VIRUSES

##### PATHOLOGY

OP.3271/19/2/2: DEVELOPMENT OF RABIES VIRUS VACCINES FOR ANIMALS  
B.J.H. Barnard

A rabies vaccine was produced by growing the high egg-passage Flury virus on baby hamster kidney cell culture. The vaccine is more antigenic than vaccine produced from the same strain of virus in embryonated hen's eggs. The cell cultures vaccine protected 6 out of 6 cats against artificial challenge which killed 2 out of 6 cats vaccinated with the egg vaccine. More cats and cattle responded to the cell culture vaccine by the production of higher levels of virus neutralising antibodies than to the egg vaccine.

Eighteen out of eighteen dogs vaccinated with the cell culture vaccine developed neutralising antibodies. Twenty-two months after vaccination the antibody titres of 8 out of 8 dogs tested varied between 1:16 and 1:256. When challenged 12 months after vaccination 6 out of 6 dogs resisted a challenge which killed 3 out of 5 control dogs.

The immunogenicity of the cell culture vaccine for guinea-pigs was enhanced by the incorporation of 150 IU hyaluronidase into each dose of vaccine, the division of a single dose into 5 portions and injection into different sites and by the presence of an oil adjuvant in the vaccine. Cattle responded markedly better to the oil adjuvant vaccine than to the ordinary cell culture vaccine.

Sixteen months after vaccination the antibody titres of cattle vaccinated with the oil adjuvant vaccine were still higher than the peak antibody titres of cattle vaccinated with the ordinary cell culture vaccine.

### Bacterial investigations

#### BACTERIA

##### PATHOLOGY

OP.32101/19/2/1: BACTERIA: CROSS-IMMUNITY BETWEEN DIFFERENT *PASTEURELLA MULTOCIDA* ISOLATES. 1974-1985  
C.M. Cameron

An effective vaccine for the immunisation of sheep against *Pasteurella multocida* infection was prepared from *P. multocida* strain D4 (type D) and a selected strain of *P. multocida* type A. Provided an adequate



## Summaries

concentration of bacteria was used, the vaccine thus formulated induced antibodies in sheep that protected mice not only against the vaccine strains but also against infection by a number of heterologous type A and type D strains as well as untypable strains.

A locally prepared  $\text{Al}(\text{OH})_3$  gel was found to be an effective adjuvant.

### BACTERIA

#### PATHOLOGY

OP.32101/19/2/2: IMPORTANCE AND OCCURRENCE OF K-ANTIGEN TYPES OF *E. COLI* IN ANIMALS IN SOUTH AFRICA. 1970

M.M. Henton

All *E. coli* strains isolated at the Veterinary Research Institute, Onderstepoort, since 1970 have been serotyped and in certain doubtful cases their pathogenicity has also been determined, which correlated well with serotyping results.

Pathogenic *E. coli* types in pigs are a small homogenous group; with by far the most common pathogen being *E. coli* 0149:K91,88. In calves the pathogenic strains form a larger group, with 078:K80; 09:K30,99 and 09:K28,99 predominating over the last few years.

*E. coli* in sheep is not often seen, but *E. coli* 026:K60 has been the most common serotype over the years.

There is still a large unresolved problem with *E. coli* in poultry as the condition is sporadic and secondary to other diseases, and so there is no continuity in samples received.

*E. coli* is not a problem in other animals in South Africa. Serotyping and recording of pathogenic types has enabled us to be flexible in the composition of the two *E. coli* vaccines so that they are maximally effective, according to the varying circumstances of disease prevalence.

### BACTERIA

#### PATHOLOGY

OP.32101/19/2/3: BACTERIA: DEVELOPMENT OF *PASTEURELLA HAEMOLYTICA* VACCINES. 1982-1985

C.M. Cameron

The antibody response to various combined polyvalent *Pasteurella haemolytica* vaccines was studied in sheep and cattle.

In sheep certain oil adjuvant vaccines gave rise to a better antibody response to *P. haemolytica* than  $\text{Al}(\text{OH})_3$ -absorbed vaccine. This finding was, however, not consistent for all serotypes and with respect to *P. multocida*, oil adjuvants had no advantage. Furthermore, it was found that the removal of all the culture supernatant fluid during the production process had no deleterious effect on the antigenicity of the product.

In cattle good responses were obtained with both alum precipitated and  $\text{Al}(\text{OH})_3$ -absorbed vaccine where all culture supernatant fluid was not removed during the production process. No advantage was gained with oil emulsion vaccines.

The degree of immunity afforded to mice and the antibody response to different serotypes of *P. haemolytica* varied considerably. Further detailed studies with respect to specific serotypes of *P. haemolytica* are therefore required.

### BACTERIA

#### PATHOLOGY

OP.32101/19/2/5: A STUDY FOR THE DIFFERENTIATION OF *ACTINOBACILLUS SEMENIS*, *A. ACTINOMYCETEM-COMITANS*, *HISTOPHILUS OVIS* AND *PASTEURELLA HAEMOLYTICA*. 1983-1984

Martha L. Swanepoel

By using well-defined techniques under optimum conditions it is possible adequately to define the

## Summaries

biochemical characteristics of typical *A. seminis* which can be distinguished from *Histophilus ovis* on the latter's distinctive colony morphology. It cannot however, be distinguished from *Actinobacillus actinomycetem-comitans*. These organisms can be differentiated from *Pasteurella haemolytica* on serological grounds and the latter's greater pathogenicity for mice. It is appreciated, however, that intermediate forms occur which cannot as yet be satisfactorily allocated to any of the abovementioned genera.

### Molecular biological investigations

#### MACROMOLECULES

##### VIROLOGY

OP.32/21/12/1/1: THE ETIOLOGY OF JAAGSIEKTE. 1971-1984  
D.W. Verwoerd and D.F. York

Jaagsiekte, or ovine pulmonary adenomatosis, was shown to be caused by a new member of the family Retroviridae. The virus cannot be cultivated *in vitro* at present, but a procedure was developed for the isolation and purification of small amounts in the form of immune complexes with IgA from affected lungs. The virion was shown to possess a 705 RNA-genome which can be transcribed by an endogenous reverse transcriptase.

Neutralisation of the enzyme and an enzyme-immune assay failed to detect a serological relationship to representatives of type B, C or D oncoviruses, or to bovine leucemia virus, maedi-visna virus of sheep or the caprine arthritis-encephalitis virus. An immunoblot technique identified a number of viral proteins, one of which cross-reacted with antiserum to the Mason-Pfizer monkey virus.

#### MACROMOLECULES

##### VIROLOGY

OP.32/21/12/1/2: AN ELECTRON MICROSCOPIC INVESTIGATION INTO THE  
AETIOLOGY OF JAAGSIEKTE. 1978-1984  
Anna-Lise Payne

Jaagsiekte or ovine pulmonary adenomatosis is a transmissible contagious tumour affecting the lungs of sheep. The main aim of this project was to identify and characterise the aetiological agent of the disease using electron microscopy. The project was completed at the end of 1982 with the exception of a number of publications which were written last year. As outlined in the 1982/83 progress report the agent was identified as a retrovirus using a combination of electron microscopy, transmission experiments and reverse transcriptase assays. A description of the morphology and morphogenesis of the jaagsiekte retrovirus (JSRV) has been published.

In 1983 another retrovirus (SCP virus) was isolated from jaagsiekte lungs on sheep choroid plexus cells (SCP cells). The SCP virus has been routinely isolated from jaagsiekte-lung macrophages since the first isolation from a lung wash pellet. Electron microscopy showed that this virus was significantly different to the jaagsiekte retrovirus in morphology. The negatively stained particles had no spikes and the particles observed in thin sections were budded with a crescent shaped core. The morphology and morphogenesis of the SCP virus are typical of lentiviruses. This was subsequently confirmed by Denis York using immune blotting techniques with an antilentivirus serum. This was the first time that lentivirus has been isolated from South African sheep. It was not known if the lentivirus replicates in the jaagsiekte lungs or if it was predominantly latent in the macrophages from which the virus was isolated.

Subsequent EM studies of jaagsiekte lungs from which the SCP virus has been isolated, demonstrated that this lentivirus is produced in alveolar macrophages *in vivo*. In two out of six jaagsiekte lungs examined it was possible to find lentivirus particles budding from macrophages. This indicated that some alveolar macrophages were actively producing virus in jaagsiekte lungs and that the JSRV isolated from JS lungs is probably contaminated with lentivirus.



# AGRICULTURAL RESOURCE UTILISATION

## RESOURCE RESEARCH

### Primary resources

#### SOIL

#### SOIL SCIENCE

GB.5111/32/1/1: CO-ORDINATION OF FERTILISER ADVISORY SERVICES FOR SOUTH AFRICA. 1975-1984

A.J. van der Merwe

As a result of the recommendations of the Fuls Report (1972), the SIRI was given the responsibility for co-ordinating soil and plant analytical services for fertiliser advisory purposes. With this task the SIRI was supported by a Co-ordinating Committee which was constituted by representatives of 13 Departmental laboratories from the Regions and Institutes. This Committee had the function to co-ordinate methods, to test methods, to co-ordinate and give guidance on calibration work, to consider the possibility of computerising the fertiliser advisory services, to establish a databank and to find a basis according to which the Committee could co-operate with the private sector. As a result of a request from the Committee during 1975 the SIRI also began a Departmental Inter-laboratory Soil and Plant Analysis Control Scheme with the main purpose of giving the 13 laboratories the opportunity to test their results against those of other laboratories and to improve the quality of the Department's analytical services.

The Committee had five meetings during the period 1972-1982 and progress with the Department's soil and plant analytical services for advisory purposes was published by means of four SIRI reports.

According to these reports the amount of soil samples submitted to the Department's laboratories for advisory purposes increased from 11 000 in 1974 to 23 000 in 1982. The amount of plant samples increased from 7 000 to 10 000 over the same period. Good progress was also made with calibration work and testing of methods. Unfortunately, the Committee could not succeed in standardising methods mainly because of the fact that it had not the necessary authority. Formal liaison with the private sector was also impossible because of the fact that no progress was made with standardisation of methods. Some laboratories succeeded in publishing guidelines and norms in connection with fertiliser advice.

During 1982 the Department of Agriculture appointed Dr M.C.F. du Plessis as Chairman of an *ad hoc* committee to investigate soil, plant, water, cattle feed and regulatory (Act 36) analytical services for agricultural purposes. One of the tasks of the Committee was to report on the co-ordination of analytical and advisory services. Some of the recommendations of the confidential report which was published in May 1983 was accepted by the Department in May 1984. It was decided that the Co-ordinating Committee would be replaced by an Inter-branch Work Team for soil fertility and plant nutrition which would mainly have the responsibility of advising the Directorate of the Department.

The nitrogen plant analysis results of the Inter-laboratory Control Scheme were summarised and will be prepared for publication.

According to this paper 92 different kinds of plant material samples were annually sent in batches to the 13 laboratories for nitrogen analysis according to their normal routine methods. The results emphasise the variation which can be obtained with different laboratories and the necessity of quality control and standardisation. Only five of the 13 laboratories succeeded in maintaining results over the six-year period within the 0,11 g N/100 g of plant material standard error per determination. The 13 laboratories reported in total 948 nitrogen analysis values of which 227 were outside the average standard deviation. Only two of the laboratories met the required standard for reproducibility.

#### SOIL

#### SOIL SCIENCE

GB.5111/32/1/2: SOIL FERTILITY STATUS OF SOUTH AFRICAN SOILS. 1975-1984

A.J. van der Merwe

The analysis of the natural resource samples, *ad hoc* investigations into soil fertility problems which are

## Summaries

encountered in practice, as well as a summary of the analysis reports of the fertiliser advisory services, gave the opportunity to determine the fertility status of RSA soils and to help identify specific problems for the fertiliser advisory services.

The facet was terminated as a result of a man-power problem and the fact that detailed information could not be collected from the 100 000 samples being analysed per annum by the advisory services. No success was attained to pinpoint soil samples on a longitude and latitude basis. It was, therefore, also not possible to establish a computer data bank systems by which the results could be analysed.

A statistical analyses of 30 000 soil samples analysed by departmental laboratories (1979-1982) showed that 16 % of the samples were acid and 3 % alkaline. Thirteen per cent of the samples were low in K and 28 % low in P. Almost 55 % of the samples were high in P and K, respectively.

By means of the *ad hoc* pot trial investigations, it was found that:

- (i) Vaalharts and Upington soils of the Mangano and Dundee soil series, respectively, had a low S, K and B status for ladino clover. The possibility of deficiencies should therefore be investigated by means of field trials.
- (ii) Arcadia soils of the Springbok Flats have low North Carolina and Isfei extractable P values in comparison with other soils on which no reaction with P fertilisation was obtained under dryland conditions.
- (iii) There are no differences in the N, P, K, Ca, Mg, S, Cu, Zn, Fe and Mn status of "Crater disease"-affected Arcadia soils on which the growth of wheat was normal and abnormal.
- (iv) Steam sterilisation resulted in an increase in the North Carolina extractable Mn content of Arcadia soils of the Springbok Flats.
- (v) The  $\text{NO}_2^-$  and  $\text{NO}_3^-$  contents of the saturated soil extracts was higher for areas where wheat growth was poor as compared to areas with good growth.

Three thousand four hundred and twenty-five natural resources samples were analysed for North Carolina extractable P, K, Ca, Mg, Na, Mn, Cu, Al, Zn and Fe,  $\text{pH}_{\text{KCl}}$  and  $\text{NH}_4\text{OAc}$  extractable Na, K, Ca, Mg and Mn. Owing to a man-power shortage it was not possible to complete the analysis. This aspect will, however, receive further attention with registered facets from the Sub-directorate Pedology and Irrigation Planning of the SIRI.

## SOIL

### SOIL SCIENCE

GB.5111/32/1/4: SOIL FERTILITY STATUS: A COMPARISON OF PHOSPHORUS  
EXTRACTION METHODS. 1975-1984  
A.J. van der Merwe

During 1978 it was established that 12 different extraction methods were used by 27 laboratories in South Africa to determine the P status of soils for fertiliser advisory purposes. Since no justification could be found for so many methods and good reasons existed for standardising methods, the Soil Fertility section of the Soil and Irrigation Research Institute (SIRI) was requested to investigate the possibility of standardising on one method.

On the basis of previous South African correlation work, overseas literature and SIRI correlation experiments, it was proposed during 1978 that the ISFEI ( $\text{NaHCO}_3\text{-NH}_4\text{-F-Na}_2\text{EDTA}$ ) method be used for reference and communication purposes between laboratories in South Africa. The results showed that P extracted with water, Bray I and ISFEI methods yielded higher correlation coefficients with P uptake and P content of sorghum than the Olsen, Mehlich, citric acid, Truog, Resin, Bray 2, double acid and EUF methods, when soils with a wide range of properties were used. Preference was given to the ISFEI method because more nutrients, e.g. Ca, Mg, K, Zn, Cu, Fe and Mn can simultaneously be extracted in comparison with the Bray I and Olsen methods. Owing to the fact that the ISFEI method extracts higher quantities of P than the water method, there is less chance for errors in routine laboratories. As a preliminary measure until the necessary field trial calibration work has been done, it was suggested that  $< 8$ , 8-16 and  $> 16$  mg P/kg of soil be used as norms for a possible, doubtful and improbable response, respectively for field crops to broadcasted P fertilisers under reasonable rainfall or irrigation conditions.

Feedback obtained from various laboratories and objections to the use of ISFEI as a reference method gave rise to an examination to discover whether or not the documented difficulties could be overcome. The influence of temperature, shaking time, charcoal treatment, acid treatment and the homogeneity and fineness



## Summaries

of samples were examined, as well as modifications of the method substituting  $\text{NH}_4\text{HCO}_3$  for  $\text{NaHCO}_3$  and  $(\text{NH}_4)_2\text{EDTA}$  for  $\text{Na}_2\text{EDTA}$ . This investigation gave rise to a modified ISFEI method, using  $\text{NH}_4\text{HCO}_3\text{-NH}_4\text{F-(NH}_4)_2\text{EDTA}$  as extracting solution and treatment of coloured extracts with HCl instead of charcoal to prevent interferences when determining P colorimetrically.

Further research is not anticipated for the future.

## SOIL

### SOIL SCIENCE

GB.5111/32/1/6: RATE OF POTASSIUM RELEASE AFFECTED BY SOIL MINERALOGY  
IN A LARGER AREA. 1984  
J.G. Thompson

The release of potassium from the solid to the soil solution phase plays an important role in the fertility of soils. It is also well known that wide differences exist among different soils in K-releasing capacity. Virgin and cultivated soil samples collected from different areas in South Africa were investigated to study the kinetics of potassium release in dilute salt solutions.

Mathematical equations were tested for K-release data to determine which kinetic equation best describes the data. The relationship between K release as a linear function of the square root of the extracted volume, was the best of various kinetic equations studied to describe the reaction rate of release for most of the soils studied. These results correspond with those previously found with pure minerals.

From the preliminary data, it was evident that the rate of release varies between soils and depends on the minerals present in the soil. Interpretation of the data obtained shows that exchangeable potassium percentages and exchangeable potassium values cannot be used as reliable indices of the K status of soils in general, although these parameters can perhaps be calibrated for a particular soil.

It is therefore suggested that this work should be followed up by K-exhaustive trials. It is also suggested that the K-release data should be used to describe the soil K status by means of kinetic parameters.

## SOIL

### SOIL SCIENCE

GB.5111/32/4/1: DEVELOPMENT OF FIELD AND LABORATORY METHODS FOR  
EVALUATING AND PREDICTING WATER FLOW IN A RANGE OF  
SOUTH AFRICAN SOILS. 1974-1984  
J.L. Hutson

This facet was concerned with characterising the properties of South African soils which influence the storage and flow of water. Methods were developed by which water retention and hydraulic conductivity (both saturated and unsaturated) of soils can be estimated from more easily determined soil properties. The relationships between soil water potential and water content  $[\theta(\psi)]$ , and between soil water potential and hydraulic conductivity  $[\kappa(\psi)]$  are required in computer simulation models to calculate soil water flow and redistribution. When appropriate relationships are used, simulated flow corresponds to the flow pattern in real soils. The appropriateness of the methods developed in this research facet to predict water distribution in soils with time, using computer simulation models, was demonstrated.

Published data and data determined by the author for South African soils were used to derive regression equations from which the  $\theta(\psi)$  relationships can be predicted by using textural criteria and bulk density. A sigmoidal, non-hysteretic, two-part retentivity function having only two constants in addition to porosity was developed for use in water flow simulation models. By varying the values of these retentivity constants through a profile, the changing soil properties in inhomogeneous soils can now be simulated with greater ease than previously.

Three different capillary models were used to calculate  $\kappa(\psi)$  relationships from retentivity data. Comparison of results showed that the definition and value of semi-empirical constants in the capillary models were as important as the choice of model in the calculated values of  $\kappa(\psi)$ . For all models the calculated  $\kappa(\psi)$  changed as would be expected for changes in texture and bulk density. Absolute values of hydraulic conductivity were however unreliable and measured values are essential for matching purposes.

A method was also developed by which the information gathered on the rate of inflow or outflow of

water after a step change in potential at the base of a soil core and the simultaneously determined water retentivity, can be used to determine the constants for the  $\kappa(\psi)$  and  $\theta(\psi)$  functions. An effective value for saturated hydraulic conductivity was obtained by matching measured outflow and inflow data to a family of simulated curves.

The applicability of the regression equations relating texture to retentivity and one of the capillary models that calculates hydraulic conductivity relationships from retentivity, was tested in a simulation study of the water regime in a weighing lysimeter in which gains and losses of water were measured accurately. Relative  $\kappa(\psi)$  curves for the various soil layers were computed as described above and used to simulate daily water potentials using three different conductivity matching factors. By matching simulated potential values to tensiometer potentials measured at five depths, an appropriate matching factor could be chosen. The effects of an over- or underestimate of  $\kappa(\psi)$  were demonstrated.

This work simplifies the prediction and use of retentivity and conductivity relationships in soil-water flow simulation models. These models can be used for assessing the water regime in both irrigated and dryland crop production. Other applications include catchment modelling, effluent disposal and nutrient and solute transport in soil.

## SOIL

### SOIL SCIENCE

V.5111/32/1/3:

SOIL: LIMING EFFECTS ON ACID MANGANO SOILS UNDER IRRIGATION AT SANDVET. 1978-1984

A. van Schalkwyk

A study was conducted to investigate the effects of dolomitic lime on a Mangano soil series under irrigation at the experimental research station of the Department of Agriculture and Water Supply on the Sandvet irrigation scheme. This investigation was necessitated by the gradual acidification of the soil of the northern part of the Free State Region, as was indicated by the decrease in pH values of soil samples submitted by farmers for fertiliser recommendation purposes.

A fully randomised block design was chosen for this trial with four treatments and nine replications. The replications were spread over time by implementing the treatments in groups of three replications annually for three consecutive years. The four treatments consisted of the following application:

1. Control, no lime
2. 0,5 tons of dolomitic lime/ha
3. 2,0 tons of dolomitic lime/ha
4. 5,0 tons of dolomitic lime/ha

Maize and barley were cultivated under accepted cultivation practices. Soil reaction, the concentration of extractable plant nutrients in the soil, the concentration of plant nutrients in the plant material, the total uptake of these elements and the biomass yield of the plants at a certain age, as well as the grain yields were monitored.

Single applications of 5 t of dolomitic limestone per hectare affected the pH values of the soil down to the 300-450 mm soil layer, although not to the same extent as in the shallower layers. Results concerning the reaction time of the applied limestone were difficult to interpret meaningfully. It seemed, however, that in the case of most levels of applications, statistically significant changes in pH values occurred only after the elapse of about 20 months. The application of 5 t of dolomitic limestone per hectare gave rise to a highly significant (1 % level) increase in pH values, in comparison with none and 0,5 t per hectare after the elapse of only 12 months.

The timely application of limestone as a corrective measure of soil reaction, is thus of cardinal importance.

No statistically significant differences regarding the extractable  $\text{Ca}^{++}$ ,  $\text{K}^{+}$ , P and  $\text{Zn}^{++}$  content of the soil owing to the different treatments were found. However, the  $\text{Mg}^{++}$  content of plots that received 5 t of dolomitic limestone per hectare was significantly (1 % level) higher than that of plots that received none and 0,5 % per hectare.

With regard to the composition of the test crops, it was found that the application of dolomitic limestone increased the  $\text{Mg}^{++}$  content of 21-day-old maize plants sampled 4, 16 and 29 months after application. This reaction was not revealed in the total Mg uptake of the plants. Furthermore, it was found that the Mn content of 21-day-old maize plants was significantly lowered by the higher applications. This



reaction became apparent 16 months after the limestone was applied but unlike Mg, it was also revealed in the total Mn uptake of the plants.

The only effect on the composition of 65-day-old barley plants was that the Mg content was raised 10, 22 and 34 months after application of the dolomitic limestone. This reaction was also reflected in the total uptake of Mg by the barley plants.

A highly significant (1 % level) increase in the grain yield of barley was obtained in this study by the application of 5 t of dolomitic limestone per hectare whereas maize showed no reaction.

Single dolomitic limestone applications of up to 5 t per hectare had therefore no detrimental effects on the soil reaction and plant nutrient content of the soil in this study. A decrease in the Mn uptake was however observed. The only beneficial effects observed were a more favourable soil reaction, an increase in the extractable Mg value which was reflected in the composition of the plants and an increased grain yield as far as barley was concerned.

No articles have thus far been published with regard to this study. Some of the results obtained were, however, used in a paper, "Evaluering van gepubliseerde DRIS-norme vir mielies en koring onder besproeiing in die Vrystaatstreek", read by Mr Kruger at a soil science congress held at Stellenbosch in 1983.

## SOIL

### SOIL SCIENCE

V.5111/32/1/4:

SOIL: THE EFFECT OF FERTILISERS ON THE SULPHUR STATUS OF A MANGANO SOIL SERIES OF THE VAALHARTS IRRIGATION AREA.

1982

A. van Schalkwyk

Statistics on fertiliser sales in the RSA during the past decade indicated that increasingly more high grade fertilisers, containing little or no sulphur, were consumed at the expense of low grade, sulphur-containing fertilisers. Considering the greater demands for sulphur by crops, which are increasingly larger owing to improved management and cultivars, the question arises whether this trend of diminishing sulphur containing fertiliser consumption will not eventually result in a sulphur deficiency, especially in sandy soils under irrigation. The leaching of sulphates on account of their solubilities may also be a major factor regulating the sulphur status of a soil.

In order to investigate the impact of these factors on the sulphur regime of a soil, a leaching study was conducted in columns with soil from a sandy Mangano series from the Vaalharts irrigation scheme. A fully randomised pot experiment using the same soil, with two treatments and eight replications was designed and carried out in the glass house. Sulphur-free fertiliser *versus* sulphur-containing fertiliser were used in the two treatments. The quantities applied were based on the initial phosphorus and potassium contents of the soil and on average uptake of these elements by lucerne.

The results showed that, depending on the degree of leaching, more sulphur could be leached from a soil than was applied in one year by a normal fertiliser programme for lucerne using low grade, sulphur-containing fertilisers. Losses through leaching were therefore an important factor controlling the sulphur status of soils with comparable texture and under similar conditions.

The effect of sulphur-free fertilisers was established by phenological observations and by monitoring the yield and the chemical composition of lucerne and ryegrass. The application of sulphur-free fertilisers resulted in the appearance of typical sulphur-deficiency symptoms in the lucerne, shortly after the third cutting. On the other hand, a highly significant ( $P = 0,01$ ) increase in yield and sulphur concentration was effected by sulphur-containing fertilisers. Mainly on account of the higher yield, but in some cases also due to higher concentration values, the uptake of all the common plant nutrients was also enhanced by sulphur-containing fertilisers. On comparable soils and under similar conditions, the use of high grade fertilisers will probably be detrimental to yield an sulphur concentration of crops such as lucerne and ryegrass.

The sulphur concentrations and N:S ratio values obtained in this experiment were apparently influenced by factors such as plant species and succession of cuttings as well as the sulphur status of the soil.

According to these results the application of sulphur *per se* as one of the basic plant nutrients (as in now the case with N, P and K) will be inevitable if increasing use is made of sulphur-free fertilisers. Therefore the need for calibration studies to determine the norms for sulphur levels in different crops and soil combinations is strongly accentuated by these results.

SOIL

SOIL SCIENCE

- W.5111/32/3/1: CHARACTERISATION OF IRRIGATED SOILS IN THE WINTER RAIN CROPPING AREAS IN RESPECT OF THEIR PHYSICAL AND CHEMICAL PROPERTIES. 1975-1985  
D.J. Beukes

A large amount of basic information was accumulated on a number of soil properties and soil-to-water relationships on dominant irrigated soils in the Winter Rainfall Region. Field work consisted of *in situ* determination of field capacity (FC) on soils of Avalon, Dundee, Fernwood, Hutton, Oakleaf and Westleigh forms. The most important findings were the following:

1. Linear correlation studies showed a poor relationship between texture (clay, silt plus clay and fine sand) and hydraulic conductivity (K), and matrix potential at FC.
2. Correlation between these texture properties and time duration from saturation to FC was even lower.
3. Cluster analysis grouped all observations into well-defined clusters on the basis of particle size fractions and soil moisture properties. Analyses further indicated that:
  - 3.1 Neither localities nor soil forms played a role in the clusterings.
  - 3.2 Matrix potential at FC is a function of hydraulic conductivity (K).
  - 3.3 There is no relationship between texture and matrix potential at FC.
  - 3.4 No relationship was found between texture or K and the duration of time from saturation to FC.
4. Factor analyses grouped 11 soil physical variables into four factors in respect of their relationship with FC. These factors indicated clay content, coarse sand, hydraulic conductivity and duration of time from saturation to FC as the best predictors of FC.
5. Multiple regressions showed that a predictive equation with four variables, namely clay, coarse sand, matrix density and hydraulic conductivity explained 78% of the variation in FC. Regression coefficients for coarse sand, matrix density and hydraulic conductivity were negative in respect of FC, but positive for clay.
6. Good linear relationships were found between FC and moisture contents determined in the laboratory at 10, 33 or 1 500 kPa on disturbed as well as undisturbed samples ( $R = 0,89-0,97$ ).

This facet makes an important contribution to knowledge of the interactions that exist between certain soil properties and soil-to-water ratios. The implementation of linear regression equations to predict field capacity from determinations in the laboratory holds great practical value.

WATER

SOIL SCIENCE

- GB.5112/32/1/2: THE USE OF AVAILABLE CHEMICAL INFORMATION TO EVALUATE THE QUALITY OF DAM WATER FOR IRRIGATION. 1972-1984  
H.M. du Plessis

Up to about 1972 almost all water analyses for assessing their suitability for irrigation were carried out by the Soil and Irrigation Research Institute (SIRI). Although limited in extent, they constitute an unique collection of historical water qualities in South Africa. The results of chemical analyses carried out between approximately 1958 and 1972 were collected and used to evaluate the suitability of the water from some 64 dams for irrigation. A summary of these analytical results for individual dams, as well as individual water quality assessments, are to be published. An evaluation of geographical water quality differences, the applicability of empirical formulae for water quality assessment compared with mathematical modelling and a global assessment of salinity and sodicity hazards, has been published.

Geographical differences in water quality were observed when evaluated according to the United States Salinity Laboratory (USSL) classification. Dams situated in the Vaal and Limpopo River catchment areas generally had a lower sodium and salinity hazard for irrigation compared with those in the rest of the



## Summaries

country. Dams in catchments areas closer to the coast tended to have a higher sodium hazard. Dams with both a high sodium and high salinity hazard were limited to the rest of the inland catchment areas.

Mean water analyses for each dam were used as a data base for calculating theoretical mean salt content of a soil irrigated from that source, and the resulting sodium adsorption ratio (SAR) of the drainage water. Two approaches, namely empirical formulae and a chemical equilibrium model developed by the USSL were used. Good agreement between the approaches was found for both mean salt content of the soil and SAR of the drainage water when lime was considered absent in the profile. Deviations, especially when leaching fractions were low, can be explained by the fact that the empirical formulae did not account for precipitation of lime or gypsum. Reasonable agreement was also found between the two approaches for the SAR of drainage water from a soil containing free lime where both dissolution and precipitation were considered. The extent to which deviations do occur, however, makes the use of a model preferable for water quality evaluations of South African dam waters.

The salinity hazard of the dam waters was generally low. In 90 % of the dams the water would not have caused yield decreases of salt-sensitive crops as a result of salt accumulation, even when leaching fractions were as low as 0.1. A substantial number of dam waters appeared to constitute a sodium hazard when evaluated according to the reduction in hydraulic conductivity of susceptible soils. The extent of the hazard was appreciably greater than could be inferred from the USSL's irrigation water classification. Differences such as these underline the necessity for using the most recently proven approaches in order to improve evaluations of irrigation water quality.

This analysis of dam waters indicated that, in general, South Africa seemed to be endowed with water of good quality for irrigation. The extent to which this picture has changed as a result of increasing industrialisation and re-use of water since the data were obtained, will have to be determined by similar investigations in the future.

## CLIMATE

### METEOROLOGY

GB.5113/33/1/5: CLIMATE: THE CLASSIFICATION OF TEMPERATURE. 1976-1983  
J. Myburgh

Techniques were developed to estimate the mean monthly maximum and minimum temperatures at any point by applying previously established regression relations between temperature and environmental factors. A general technique for estimating temperature for the country as a whole needs altitude, longitude and latitude as input. A technique which gives better spatial resolution has been developed for the Winter Rainfall Region. In this case, the estimates are based on altitude, latitude, longitude, distances from the south and west coasts and a topographic index. The topographic index indicates whether a point lies in a valley or against a slope. Computer programmes have been written to perform the estimates.

Fairly accurate estimates of the mean monthly maximum and minimum temperatures are possible with these techniques, except at coastal localities where large errors can occur. Slight spatial bias in the errors do occur, especially in the case of maximum temperatures during the summer.

The general estimation technique was used to calculate the mean monthly temperatures at the points on a square grid. The points were classified in ten groups according to the calculated temperatures. The classification strategy results in points being grouped in geographical coherent units, but on the other hand regions not considered to be homogenous were often grouped together in one class. Cluster analysis was also performed to classify 447 weather stations according to the observed mean monthly maximum and minimum temperatures. In this case much spatial scattering of stations belonging to the same class occurred with the resulting regional overlapping of different classes. This scattering and overlapping make geographical demarcation of stations of the same group impossible.

The results indicate that little agricultural significance can be attached to a general temperature classification of this kind.

## CLIMATE

### METEOROLOGY

GB.5113/33/1/7: THE IDENTIFICATION OF HOMOGENEOUS CLIMATIC REGIONS FOR  
WHEAT PRODUCTION. 1979-1984  
J. Myburgh

In order to enhance recommendations about the suitability of areas for the production of different

wheat cultivars, the Orange Free State was divided in homogenous climatic regions. The classification was based on climatic parameters which were considered to influence wheat yield, namely the monthly averages of rainfall, maximum and minimum temperature, relative humidity, evaporation and hours of full sunshine.

The points at which climatic information were available were insufficient for a meaningful classification and a more dense network of points was generated by interpolation between isohyets drawn of the parameters. Two methods of classification were used. In the first instance, a distance parameter was used to demarcate homogeneous areas around 15 localities which were considered to be representative of the different homogeneous wheat production areas. Secondly, the Orange Free State was divided in 9 homogeneous areas by cluster analysis.

The evidence indicates that the classification with cluster analyses gives better results than the grouping around previously selected localities. The forms and shapes of the homogeneous groups show that the gradient of climatic change in the Orange Free State is the strongest from the north-west to the south-east.

## **RESOURCE UTILISATION RESEARCH (CROPS)**

### **Summer rain cropping areas**

#### **SUMMER GRAIN**

#### **NUTRITION**

##### **SUMMER GRAIN: NUTRITION REQUIREMENTS OF MAIZE IN THE SUMMER RAIN CROPPING AREAS. 1971-1981**

W.J. Conradie

The pH values of the experimental plots were noticeably increased as a result of lime/silicate applications. In contrast, gypsum application had the opposite effect, lowering the pH of the soil.

The concentration of the extractable Al was greatly lowered on the lime/silicate plots and increased on the gypsum plots. Application of gypsum resulted in an increase in the extractable Al.

The maize yield showed the most significant increase on the lime/silicate plots and the least significant on the gypsum plots.

## **RESOURCE UTILISATION RESEARCH (ANIMALS)**

### **Bushveld areas**

#### **LARGE STOCK**

#### **PHYSIOLOGY**

D.Sc. (Agric.) thesis: **THE EFFICIENCY OF PREWEANING GROWTH IN CERTAIN BEEF,  
DUAL PURPOSE AND CROSSBRED CATTLE IN THE SWEET  
BUSHVELD OF THE NORTHERN TRANSVAAL. 1948-1977**

H.A.W. Venter

Promotor: Prof. G.N. Louw

The efficiency of preweaning growth is influenced by many interrelated factors. The relative influence of these factors varies with environment but under conditions of the sweet bushveld, the size and milk production of the cow, as well as the inherent growth potential of the calf appear to be the most important factors.

Norms for the performance of the various breeds and types studied together with the size of the effects of independent variables are presented. The functional efficiency of the cow is perhaps the most important factor influencing the size or mass of the cow. Differences in size and type as presented by various breeds have an important influence on cow efficiency.



LARGE STOCK

NUTRITION

THE NUTRIENT POTENTIAL OF NATURAL PASTURE OF THE  
NORTHERN CAPE FOR BEEF COWS. 1977-1980

E.A.N. Engels, Marion V.P. Read and M.C. Basson

Seasonal variation in organic matter digestibility (OMD) and crude protein (CP) content was characterised and feed intake determined, to evaluate the potential of the natural pasture for beef cows.

Pasture samples collected by oesophageally fistulated steers from 2 soil types (i.e. type 1: the dry flat water courses and type 2: the Morokaan hills), differed little in OMD, although CP content tended to be higher in samples from soil type 1.

The effect of soil type appeared greater for the crossbred cattle, which had a more marked tendency for higher intakes when grazing pasture from soil type 2. The intakes of both cattle types were essentially the same for soil type 1 and varied from 40,8 to 77,4 g digestible organic matter (DOM)/W<sup>0,75</sup>kg/day from 46,3 to 87,3 DOM/W<sup>0,75</sup>kg/day for A and A x S cows, respectively. Intakes from soil type 2 differed considerably between cattle types during the latter part of the trial although the variation was similar to that of type 1 (41,4 to 91,1 and 46,0 to 87,3 g DOM/W<sup>0,75</sup>kg/day for A and A x S cows, respectively). The intakes from both soil types were generally adequate for both cattle types, except occasionally for lactation.

The pasture from both soil types provided adequate quantities of DOM and CP, which suggests that no further supplementation, other than a mineral lick, is required by beef cows grazing these pastures at the applied stocking rates of 8 ha per cow.

LARGE STOCK

UPGRADING

LARGE STOCK: AN EVALUATION OF METHODS FOR DECREASING  
THE INTERCALVING PERIOD IN AFRIKANER COWS. 1979-1982

J.A. Vermeulen

In an effort to shorten the intercalving period of cows under extensive conditions three groups of Afrikaner cows (n = 18 per group) were either treated with gonadotrophin releasing hormone (GnRH) 35 days *post partum* and then mated (Group 1), allowed to suckle their calves, which had free access to a concentrate, once daily during the mating period (Group 2) or were mated normally (Group 3).

Restricted suckling reduced the intercalving period to 358 days *versus* a mean of 271 days for Group 1 and 375 days for Group 3, but affected calf weaning mass adversely. Mean calving percentage did not differ between groups.

Control of ovulation through the applicaiton of GnRH under extensive conditions is not feasible yet. If the handling problems and the low weaning mass associated with restricted suckling can be eliminated, it could be applied as a managerial tool to decrease intercalving periods.

Summer rain cropping areas

LARGE STOCK

NUTRITION

BEEF PRODUCTION FROM WINTER GRAIN PASTURES ON A  
SHALLOW AVALON SOIL IN THE EASTERN PART OF THE SUMMER  
RAIN CROPPING AREA. 1979-1980

K.G. Cronje, U.T. Müller and A.J. van Heerden

Drakensberger x Simmentaler steers and heifers were subjected in a trial at the Small Grain Centre,

## Summaries

Bethlehem for two consecutive years to the following treatments:

1. Silage fed *ad lib.* plus 1,8 kg concentrate/head/day (96 % lucerne meal and 4 % urea) (S)
2. Oats grazing (O)
3. Rye grazing (R)

Animals in all three treatments had access to a salt-phosphate lick.

During both years the daily mass gains of animals grazing on oats (0,76 and 0,86 kg) and rye (1,00 and 0,81 kg) were higher ( $P < 0,05$ ) than those of animals receiving the silage ration (0,54 and 0,55 kg). The quality of the silage could have been a factor influencing this result. The differences in respect of carcass grade, eye muscle area and dressing percentage were non-significant ( $P > 0,05$ ). The carcasses were leaner than preferable, possibly because of too short a grazing and feeding period before slaughter (average final mass of 324 kg).

It was concluded that the use of winter grain pastures for the fattening of beef cattle can be a good proposition but it is suggested that energy may be lacking. It should be kept in mind that cereal pasture production is prone to high risk owing to adverse climatic conditions.

## LARGE STOCK

### NUTRITION

#### LARGE STOCK: MILK PRODUCTION FROM WINTER CEREAL PASTURES ON A SHALLOW AVALON SOIL IN THE EASTERN PART OF THE SUMMER RAIN CROPPING AREA. 1978-1985

U.T. Müller

Three groups of four cows per group were kept on oats, *Triticale* and rye pastures, while a fourth group received maize silage as sole source of roughage. After each grazing period of 10 days, animals were randomly allotted to another treatment and allowed an 11-day adaptation period. Concentrate supplementation was only given in the case of the silage treatment, since maize silage normally contains less crude protein than pastures.

The crude protein content of the rye pasture each year was significantly higher ( $P \leq 0,05$ ) than that of any of the other roughages, with the highest value in the driest year (19,1 %) and the lowest value in the wettest year (14,2 %). The higher crude protein content of the rye pasture was also accompanied by a higher dry matter intake and milk production.

Mean daily milk production during the four-years experimental period was 13,3 kg for rye pasture, 12,6 kg for oats pasture, 11,2 kg for maize silage, and 10,4 kg for *Triticale* pasture.

The only significant difference in butterfat content occurred in year 2 when it was higher for the *Triticale* treatment than for the rye treatment (4,83 % versus 4,17 %). The protein content of the milk was always lower ( $P \leq 0,05$ ) for the silage treatment (mean of 3,3 %) than for any of the other treatments (3,7; 3,8 and 3,9 % for rye, oats and *Triticale*, respectively). The lowest lactose content was observed for the *Triticale* treatment (4,6 %) which was significantly lower ( $P \leq 0,05$ ) than that of the rye treatment (5,0 %).

It was concluded that, even under relative dry conditions, winter cereal pastures may be utilised successfully by dairy cows, with production costs comparing favourably with that of maize silage.

## SMALL STOCK

### NUTRITION

#### SMALL STOCK: THE INFLUENCE OF THE RATIO OF MANURE TO MAIZE RESIDUES ON THE FEEDING VALUE OF ENSILED MANURE-MAIZE RESIDUE MIXTURES IN THE SUMMER RAIN CROPPING AREAS. 1979-1984

L.D. Snyman, René du Preez and Irma Calitz

The purpose of the present investigation was to investigate the effect of the ratio of manure to maize residues on the ensiling characteristics and nutritive value of the ensiled manure-maize residue mixtures.



Manure (fresh), obtained from steers on a high concentrate diet was ensiled on a laboratory scale with maize residues in ratios of 50:50, 60:40, 70:30 and 80:20 for a period of six weeks. The ensiled mixtures were then analysed for nutritive value in terms of *in vitro* dry matter digestibility, acid detergent fibre, neutral detergent fibre, crude protein, true protein and water soluble carbohydrates and for fermentation characteristics by measuring pH, lactic acid, acetic acid, butyric acid and ammonia nitrogen. Effective preservation with a favourable fermentation pattern was obtained which was little influenced by the ratio of manure to maize residues. The nutritive value of the silage showed some increase with an increasing ratio of manure to maize residues. A possible optimum ratio at 70:30 was observed for *in vitro* dry matter digestibility.

This investigation showed that a favourable type of fermentation took place which was not very sensitive to ratios varying between 50:50 and 80:20. That predicts that some variation around the optimum ratio may be allowed under practical circumstances of ensiling.

## Eastern seaboard areas

### SMALL STOCK

#### MANAGEMENT

#### SMALL STOCK: THE USE OF A PLASTIC COAT TO CUT DOWN LAMB MORTALITIES IN THE GEORGE AREA OF THE EASTERN SEABOARD.

1982-1984

S.W.P. Cloete

#### Materials and methods

The effect of prevailing weather conditions on lamb mortalities, and the application of plastic coats to newborn lambs to reduce neonatal mortalities were simultaneously investigated. The investigation included data of 768 S.A. Mutton Merino lambs born alive during the 1982 spring and 1983 autumn lambing seasons. Within lambing seasons lambs were randomly allocated to an experimental group provided with coats and an untreated control group. Weaning mass, mortalities prior to weaning and ewes temporarily deserting their lambs were recorded. These data were analysed by least squares procedures.

Climatological data for the appropriate periods were furthermore obtained to investigate the relationship between preweaning mortalities and prevailing weather conditions.

#### Results and conclusions

The least square means for the parameters during the respective lambing seasons and management groups nested within lambing seasons were recorded. Results indicated that the provision of lambs with plastic coats tended to increase the proportion of lambs temporarily deserted by their mothers. This effect was statistically significant ( $P < 0,05$ ) during the 1982 spring lambing season. The provision of plastic coats did not affect weaning mass of lambs adversely. Climatological results indicated that the 1982 spring lambing season was relatively cold and windy, whereas the 1983 autumn lambing season could be described as mild. It is therefore possible that the significantly ( $P < 0,01$ ) higher survival rate of lambs born in the 1983 autumn lambing season could possibly be ascribed to the climatological differences between lambing seasons. The provision of plastic coats significantly ( $P < 0,05$ ) improved the survival rate of lambs by 8,2 % in the comparatively cold and windy 1982 spring lambing season. In both the above-mentioned cases, the reduction of lamb mortalities could mainly be attributed to a higher survival rate of multiple born lambs. In the mild 1983 autumn lambing season, the survival rate was high and independent of experimental groups. It was concluded that the provision of plastic coats may advantageously affect lamb survival under certain conditions.

## High rainfall sourveld areas

### LARGE STOCK

#### REPRODUCTION

#### LARGE STOCK: THE INFLUENCE OF RESTRICTED SUCKLING ON THE REPRODUCTIVE PERFORMANCE OF BEEF CATTLE COWS IN THE HIGH RAINFALL SOURVELD AREAS AT CEDARA. 1980-1982

B.P. Louw, A. van Niekerk and A.W. Lishman

A total of 37 first-calf cows and their calves, comprising 19 Drakensbergers and 18 Hereford x

## Summaries

Simmentalers, were subjected to either normal or once-daily suckling for 15 days, commencing at either day 35 or 60 *post partum* in a 2 x 2 x 2 factorial experiment.

All cows received common hormone therapy during the normal or restricted suckling periods. A Norgestomet ear implant was inserted in conjunction with an oestrogen injection on the first day, and removed on the tenth day of the variable suckling periods. The cows were injected with gonadotrophin releasing hormone (GnRH) 30 hours after the removal of the ear implants, and inseminated 18 and 42 hours after the GnRH injection. There was a tendency for a greater proportion of the cows suckled once daily to ovulate than those suckled normally, and this effect was most marked in the Drakensberger cows treated between days 60 and 75 *post partum*. In the Drakensbergers, restricted suckling tended to increase the proportion of cows which conceived to the fixed-time inseminations, and to decrease the incidence of "short" oestrus cycles following GnRH.

Tonic luteinizing hormone (LH) levels and oestrogen secretion were not affected by any of the variables studied. Drakensbergers suckled normally secreted ( $P < 0,05$ ) more LH than the Simmentaler x Herefords. Drakensberger cows suckled once daily secreted significantly ( $P < 0,05$ ) less LH in response to GnRH than those suckled normally. In the British-cross cows the suckling intensity did not influence the amount of LH released in response to GnRH.

The improvement in ovulatory response owing to restricted suckling obtained in this study suggests that the relatively poor reproductive rates common to many South African beef herds could be improved by techniques involving a reduction of the suckling frequency. First-calf cows, late-season calvers and *Bos indicus* females are likely to benefit most by the use of such techniques.

## LARGE STOCK

### NUTRITION

#### NUTRITION: UTILISATION OF MONENSIN IN LICKS FOR BEEF CATTLE ON SOURVELD 1979-1982

W.P. Henning, H. Barnard and J. Compaan

Monensin was fed to Bonsmara/Bonsmara type heifers on Dohne sourveld by means of winter and summer licks. The summer lick consisted of bone meal 60 %, salt 35 % and molasses 5 %. The winter lick was compounded from maize meal 30 %, urea 15 %, bone meal 25 % and salt 30 %. The monensin content of licks was calculated at a daily consumption of 200 mg monensin per large stock unit (LSU). A minimum availability of 7 kg dry material per beast per day during both summer and winter, was aimed at. Extended drought conditions interrupted the unintermittent run of the study.

Monensin intakes closely followed the calculated minimum (200 mg/LSU/d) on veld but increased to 500 mg under penned conditions. The presence of monensin in winter and summer licks had inconsistent effects on lick consumption and animal performance. A slightly positive influence on voluntary roughage intake was found under penned conditions. This difference being significant ( $P \leq 0,05$ ) in the 1981 season only. This was accompanied by significantly lower mass losses. At the minimum level of roughage availability (7 kg DM/d), monensin exerted a positive influence on both lick intake and daily gain during the 1979/80 summer season. Roughage availability was below the prescribed minimum during the 1981/82 summer season. This resulted in the opposite trend for lick intake and body mass gain.

During the winter of 1981 the intake of the lick containing no monensin was higher than that containing monensin. Mass loss was lower with the lick containing no monensin. In the winter of 1979, roughage availability fell below the prescribed minimum. Here both lick intake and body mass losses followed opposite trends. Differences in body mass changes between treatments were not significant in either summer or winter periods.

## LARGE STOCK

### NUTRITION

#### NUTRITION: THE ROLE OF HIGH FAT WHEY POWDER IN CALF MILK REPLACERS. 1979-1980

W.P. Henning

The cost of liquid feeds justified the investigation of high fat whey (HFW) inclusion levels in calf milk replacers. The latter is a relative inexpensive product which is manufactured through the addition of 24 %



homogenised tallow to the whey during the spray drying process. Nine HFW-inclusion levels ranging from 20 to 100 % in the milk replacers were applied to 45 Friesian bull calves as treatments. A calf starter meal containing 28 % protein was freely available.

The intake of the starter meal in treatments which exceeded the 60 % HFW-inclusion level was significantly ( $P < 0,05$ ) lower. A significant ( $P < 0,01$ ) decrease in the average percentage DM digestibility occurred where the 60 % HFW is exceeded.

The digestibility of the starter meal and fibre decreased significantly ( $P < 0,01$ ) with increasing HFW inclusion levels. This decrease is mainly associated with the adverse effect of high levels of fat on digestibility.

The protein: energy ratio played an important role in the efficiency of N digestibility and N retention.

The results of this trial indicate that 60 % is the optimum HFW-inclusion level for calf milk replacers. This treatment was economically and biologically the most efficient in producing live mass gains.

## SMALL STOCK

### NUTRITION

#### NUTRITION: UTILISATION OF MONENSIN IN PROTEIN ENERGY LICKS BY LACTATING EWES ON SOUR WINTERVELD. 1979-1982

W.P. Henning

The effect of monensin on the wool and mutton production of Dohne Merino ewes and lambs was investigated during the winter seasons of 1979 to 1981.

Monensin was added to high (HEL) and low (LEL) energy protein licks to supply 0,11 and 22 mg monensin/ewe/day, respectively. A 2 x 3 factorial set of treatments with 12 lactating ewes per treatment was applied. All the lambs received creep feed *ad lib* without monensin.

The increasing monensin inclusion levels had no significant effect on the daily hay intake (999 to 1 242 g), DM digestibility (54,3 to 57,5 %), daily mass loss of the ewe (214 to 282 g), daily creep feed intake (700 to 1,313 g) and ADG of the lambs (173 to 212 g). The ewes offered the lick supplying 22 mg of monensin/day showed intakes (329 g) lower ( $P < 0,01$ ) than those on the 11 mg inclusion level (370 g) and those receiving zero monensin (446 g).

In the main study, monensin was included in the HEL, the LEL and the creep feed to supply 0,36 mg/kg body mass as determined by the daily intake of the lick or creep feed.

The average daily intake of lick without monensin (289 g) was higher ( $P < 0,01$ ) than lick plus monensin (206 g). Lower ( $P < 0,05$ ) daily intake of creep per lamb was obtained with creep feed plus monensin (170 g) than without (320 g). The energy content of the lick as well as the presence of monensin had no significant effect on the dry matter digestibility.

From the results of this study, it appears that although monensin reduced the feed intake and the growth rate, it increased the efficacy of feed utilisation at feeding levels above maintenance. At feeding levels below maintenance monensin decreased the efficacy of feed utilisation.

## Karoo and arid areas

### SMALL STOCK

### PHYSIOLOGY

#### PERINATAL LOSSES IN SMALL STOCK: EFFECT OF COLD ON THE ABORTION IN THE ANGORA GOAT. 1979-1984

D. Wentzel

The object of the investigation was to establish means to increase blood glucose concentration through nutrition in Angora goats to combat abortion. Several alkali's and/or ionophores were used to treat yellow maize in order to overcome the problem of acidosis, thereby allowing goats to ingest maize on an *ad lib*. basis. NaOH,  $\text{NH}_4\text{OH}$  and  $\text{Ca}(\text{OH})_2$  in combination with either monensin-sodium or lasalocid proved to be equally effective. A maximum average increase of 56 % in circulating blood glucose was recorded for experimental animals receiving the alkali-ionophore-treated maize.

## SMALL STOCK

### NUTRITION

#### INFLUENCE OF PHOSPHORUS ON THE PRODUCTION AND REPRODUCTION OF KARAKUL EWES ON NATURAL GRAZING OF THE KARAKUL RESEARCH STATION. 1981-1984

A.S. Faure

The phosphorus (P) status of adult Karakul ewes grazing natural pasture was studied in terms of P content of blood, saliva, faecal and bone samples. Reproduction (twice per annum) and supplement intake was recorded. Eighty ewes were divided into four groups of 20 ewes each, *viz* ewes lambing in May and October (2 groups) and each of these two groups subdivided into a -P and +P supplement group (control and P groups, respectively).

The nutritive value of the pasture during the experimental period as sampled by oesophageally fistulated sheep was studied in terms of crude protein content and *in vitro* digestibility. The estimated digestible organic matter intake (DOMI) indicated that it was insufficient for satisfying the maintenance energy requirements of the ewes. This could be related to a limited dry matter intake as the digestibility of the OM ingested was adequate. Crude protein (CP) intake during one third of the experimental period, was insufficient to meet maintenance protein requirements of the ewes.

P supplementation had no effect on reproduction and body mass of the ewes. Supplement intake by the two supplemented groups were correlated ( $r = 0,56$ ). The average daily supplement intake (g sheep) during the experimental period for the control and phosphate supplement groups were, respectively 4,87 g and 6,60 g. The latter figure implied an average daily phosphorus intake of 0,51 g during the experimental period.

Saliva phosphorus concentration was positively correlated between supplemented groups ( $r = 0,63$ ) and with crude protein content ( $r = 0,53$ ) of the natural pasture, with average values of 45,73 and 45,17 mg P %, respectively for the control and phosphate supplement groups.

Blood and faecal phosphorus concentrations were variable. This variation was not reflected in bone phosphorus concentration. Rib-bone phosphorus concentration varied between 140 and 157 mg P/cm<sup>3</sup> fresh bone.

These results were recorded under poor feeding conditions with unfavourable protein and energy intakes which could enhance P absorption from the diet. Nevertheless no proof was found of a negative phosphorus status. Phosphate supplementation to Karakul sheep grazing natural pasture in the Gordonia district is therefore not necessary.

## SMALL STOCK

### NUTRITION

#### THE EFFECT OF FOOD UTILISATION WITH REGARD TO GROWTH AND BODY COMPOSITION OF DORPER SHEEP. 1976-1984

P.G. Marais

This study was undertaken to quantify sex differences in the body composition of Dorpers during their growth phases.

Lambs were artificially reared on an *ad libb.* basis. One lamb per sex was slaughtered every week till the age of 13 weeks, and after that fortnightly till the age of 39 weeks. The bodies of all the lambs were analysed in total for DM, protein, fat, ash and energy content.

The relationship between body mass and the different chemical components of the body (energy, fat and protein) shows that energy increases at 1,69 to 1,76 times faster than body mass after 13 weeks of age, whereas fat increases at 1,75 to 1,96 times faster than body mass for the same age interval. Protein increases at a rate of 0,85 times faster than that of the body mass of ewes and rams, whereas that of wethers increases at a rate of 0,77 times faster than that of body mass. At 13 weeks of age rams consist of 8 % more body protein than ewes and 7 % more than wethers.

After 39 weeks (end of the experimental period) the rams have 18 % more protein than ewes and 9 % more than wethers. Wethers have 12 % more fat than ewes and 15 % more than rams.

The AO-model, based on the logarithmic form of the Gompertz equation [ $x_i = d_i - \beta_i \exp(-\gamma t)$ ] to approximate growth with time and the logarithmic form of the allometric equation ( $\ln y = \ln a + b \ln x$ ) to



approximate growth of one component relative to another, was used to describe the interrelationship of various growth variables.

Nett energy (NE) requirements for maintenance and growth were calculated from 10 to 60 kg body mass for the different sexes. The accuracy of the ME values, as estimated by the AO-model, was measured against the ME values as predicted from the nett energy system. According to this, AO-model, which estimates feeding standards from an *ad lib.* basis, estimates feeding standards for young growing animals fairly accurately.

## SMALL STOCK

### NUTRITION

#### NITROGEN RETENTION OF ANGORA GOATS RECEIVING ALKALI-IONOPHORE-TREATED WHOLE MAIZE CONTAINING VARIOUS LEVELS OF UREA. 1983-1984

Verena Gevers and D. Wentzel

A nitrogen-balance study was carried out to investigate the utilisation of various levels of urea (0-4 %) absorbed into alkali-ionophore-treated whole maize when fed to Angora goats receiving a protein-deficient roughage diet.

Nitrogen-retention was increased significantly ( $P < 0,05$ ) only in the experimental groups receiving 3 % and 4 % urea in the grain component of the diet.

## SMALL STOCK

### NUTRITION

#### SMALL STOCK: THE DETERMINATION OF THE MINIMUM INCLUSION RATE OF ROUGHAGES IN A CHOCOLATE MAIZE RATION FED FOR THE FATTENING OF WOOLLED SHEEP IN A FEEDLOT IN THE KAROO AND ARID AREAS. 1983-1984

A.W.D. Kotze and P.G. Marais

This study was undertaken to determine the minimum inclusion rate of roughage in a chocolate maize ration fed to woolled sheep for fattening purposes. This information is of importance in establishing a feeding practice during a period of roughage shortages, e.g. droughts.

The experimental animals consisted of 48 Merino lambs, divided into 4 groups of 12 each. Each group was subjected to a different inclusion rate of roughage (lucerne) namely, 0 %, 10 %, 20 % and 30 %.

According to the average feed intake (kg/animal/week) a great variation in intake over the experimental period of 19 weeks was observed. Nevertheless, the intake of the animals in the group with no roughage inclusion in the diet, was constantly lower than that of the other groups. The group with a 20 % roughage inclusion recorded the highest intake. The differences in intake between the groups were not significant.

The average growth rate (kg/animal/week) shows clearly that the group with no roughage inclusion has the lowest growth rate. The differences in the growth rate of the lambs in the 10 %, 20 % and 30 % inclusion rate groups, vary little. The differences between the growth rate of the group receiving no roughage and the rest were not significant. The carcass grading also provided no significant differences between the groups.

In conclusion it is clear that it is possible to fatten Merino lambs on a chocolate maize diet with minimum roughage inclusion. During droughts where a roughage shortage occurs, these results can be of great value.

## OSTRICHES

### NUTRITION

#### THE EFFECT OF DIET PROTEIN AND ENERGY LEVELS ON THE GROWTH PERFORMANCE AND FEATHER PRODUCTION OF SLAUGHTER OSTRICHES. 1982-1984

D. Swart

The effect of different protein and energy levels on the growth performance and feather production of

slaughter ostriches under feedlot conditions was investigated. Lucerne, maize and ostrich carcass meal were used to formulate nine treatment diets to supply three protein levels of 14, 16 and 18 %, respectively, each with three roughage:concentrate ratios (energy levels). Each diet was fed to a group of six birds. A conventional ostrich diet with a protein level of 14 %, consisting of 70 % dry lucerne was included as a separate control diet.

Group feed intake and individual masses were recorded weekly from 250 and 462 days of age under feedlot conditions. Growth rate and feed conversion rate were calculated for each group over the live mass interval from 60 to 110 kg.

Between treatment diets the average growth rate varied from 128,93 to 239,86 g with an overall average of 188,52 g/day compared to the control diet with a growth rate of 178,68 g/day. Feed conversion rate varied from 10,01 to 15,45 with an average of 12,77. With respect to the energy concentrated diets, this represented a marked improvement over the control diet that was consumed with a feed conversion rate of 14,78. At all three protein levels, growth rate as well as feed conversion rate were improved by an increase in energy level. Above 80 kg live mass, feed intake declined curvilinearly with respect to all treatments with the least effect at the low energy levels, including the control diet. Together therewith growth rate and feed conversion rate deteriorated almost linearly.

Pluckings of body feathers had an overall mean mass of 707,10 g and differences between feather yields as well as feather quality were not significant ( $P \leq 0,05$ ).

In terms of growth rate and feed consumption a diet composition with a protein level of 14 % consisting of 35 % dry lucerne gave best results at a feed conversion rate of 10,01 over the live mass interval 60 to 110 kg. The digestible energy and protein values in question were, however, derived from pig standards and the obtained results are therefore restricted to the diet compositions of the present study.

## Winter rain cropping areas

### SMALL STOCK

#### MANAGEMENT

#### MANAGEMENT: CAUSES OF LAMB MORTALITY WITH SHEEP, IN THE WINTER RAIN CROPPING AREA. 1978-1981

A.A. Brand

#### Material and methods

The effect of intensive management and care during the lambing season on preweaning mortality were investigated. Phenotypic factors associated with and causes of preweaning mortality were simultaneously investigated. Data related to 1852 SA Mutton Merino and Dormer lambs born in the Elsenburg flocks, during the period 1978 to 1981 inclusive, were analysed by least square procedures. The lambs were classified within years and breeds and within an intensive group, which was housed with constant supervision during lambing and the neonatal period, and an extensive group, where the lambing was supervised three times daily in pasture paddocks.

#### Results and discussion

Results from the investigation indicated a significantly ( $P > 0,05$ ) higher occurrence of preweaning mortality amongst SA Mutton Merino lambs. Preweaning mortality rates of 21,8 and 17,6 % were obtained for the respective breeds. This difference could mainly be attributed to a significantly ( $P > 0,01$ ) higher occurrence of mortality during birth in SA Mutton Merino lambs. Mortality during birth accounted for 44 and 27 % of the preweaning mortality in SA Mutton Merino and Dormer lambs, respectively. Mortality during the period 1 to 3 days *post partum* were significantly ( $P > 0,05$ ) decreased by intensive management. This decrease amounted to 36,1 and 53,7 % for SA Mutton Merino and Dormer lambs, respectively. Mortality from 1 to 3 days *post partum* accounted for only 13,8 and 22,7 % of the preweaning mortality of lambs of the respective breeds.

The other parameters investigated were not significantly affected by intensive management. The preweaning mortalities amongst SA Mutton Merino and Dormer lambs were nevertheless significantly ( $P >$



0,05) decreased from 23,3 and 20,6 to 20,4 and 14,6 %, respectively. Preweaning mortality amongst triplets in both breeds were about twice the rate than that amongst twins and singles. Respective preweaning mortality rates of 38,5; 19,8 and 19,6 % were obtained for triplet, twin and single SA Mutton Merino lambs. Corresponding figures for Dormer lambs were 3,3; 17,0 and 16,3 %, respectively. The relationship of birth mass with preweaning mortality, mortality during birth and mortality during the period 1 to 3 days after birth were presented graphically. The relationship between mortality during birth and birth mass was curvilinear for both breeds. Mortality during *partus* tended to be higher amongst the lighter and heavier lambs of both breeds. Mortality from 1 to 3 days *post partum* tended to decrease with an increase in birth mass.

Preweaning mortality occurred mainly amongst the lighter lambs of both breeds, while the mortality rate amongst the heavier SA Mutton Merino lambs tended to be relatively high as well. Sex did not significantly affect any of the mortality parameters investigated. Significantly ( $P > 0,01$ ) more birth problems were, however, recorded in SA Mutton Merino ram lambs when compared to ewe lambs of the same breed.

Preweaning mortality amongst lambs born to SA Mutton Merino ewes of 7 years and older were significantly ( $P > 0,01$ ) higher than in ewes of other age groups. This difference could mainly be attributed to a higher occurrence of mortality during *partus* and mortality from 4 to 10 days *post partum* in the ewe age group of 7 years and older. Preweaning mortality amongst Dormer lambs was relatively independent of dam age. The most important causes of losses were dystocia, still births, lambs smothered by their dams, starvation, predation by predators and dogs, and premature lambs. In many cases it was impossible to identify the exact cause of death.

## Irrigation areas

### SMALL STOCK

#### NUTRITION

#### UTILISATION OF LUCERNE (*MEDICAGO SATIVA*) UNDER IRRIGATION FOR SHEEP PRODUCTION. 1979-1984

A.G. Bezuidenhout

The utilisation of lucerne (*Medicago sativa*) by reproducing Merino ewes was studied on Cradock Experimental Plot. Chopped lucerne hay was fed in a feedlot and lucerne was also grazed on 10 % flowering stage and also on 150 to 200 mm growth height, on a short grazing duration cycle. The two grazing groups wintered on wheat pasture and on lucerne hay in a feedlot.

On grazing the best results were obtained on the 150 to 200 mm growth height. The lower production obtained on the 10 % flowering stage can be ascribed to more stalkiness of the lucerne at that growth stage and more selective grazing. Wool production on the two growth stages was 6,6 and 6,4 kg clean-fleece mass per ewe on the 150 to 200 mm growth height and 10 % flowering stage, respectively. On the 150 to 200 mm height, lambing percentage was 120 % compared to 126 % on the 10 % flowering stage.

No additional energy was given to the sheep on pasture. In the feedlot a ration of lucerne hay with a 20 % addition of maize meal during late pregnancy and lactation was given. Clean-fleece mass of 6,92 kg per ewe and a lambing percentage of 146 % was achieved.

On the lucerne pasture Afrino x Merino lambs achieved a higher growth rate compared to lambs in the feedlot up to weaning at 100 days. After weaning the growth rate of the lambs in the feedlot was higher than that of the lambs on lucerne pasture.

All indications are that good management is crucial to obtain and sustain high levels of animal production on lucerne pasture and at the same time maintain a good quality pasture on a high production level.

## RESOURCE UTILISATION RESEARCH (PASTURES)

### Bushveld areas

#### CULTIVATED PASTURE

#### NUTRITION

#### CULTIVATED PASTURE: DETERMINATION OF THE FERTILISER REQUIREMENTS OF *ANTHEPHORA PUBESCENS* IN TERMS OF N, P and K ON A SOIL OF THE MANGANO SERIE AT VAALHARTS. 1976-1983

J.H. Fourie and L.G. du Pisani

*Anthephora pubescens* is a perennial, tufted grass with a characteristic rosette of basal leaves and long,

thin stems of 40 to 120 cm in height. It is described as a very palatable climax grass found on a variety of soils. According to the literature, *A. pubescens* is a potentially valuable species in cultivated pastures and is prevalent in regions with an annual rainfall of 250 to 650 mm. The most outstanding characteristics of *A. pubescens* are the following:

- it is strongly perennial,
- it is easily grown from seed,
- produces well on poor soil (low nutrient content) and
- is highly palatable

The response of *A. pubescens* to N, P and K fertilisation with regard to dry matter production was investigated at Vaalharts Agricultural Research Station.

Three levels of N (0, 75 and 150 kg/ha), P (0, 10 and 20 kg/ha) and K (0, 75 and 150 kg/ha) were applied. Treatments (fertilisation) were randomised in a 3 x 3 factorial experiment with three replications (blocks). Individual plots were harvested when all three replications of a treatment reached the early flowering stage.

In terms of dry matter production *A. pubescens* responded poorly to nitrogen. The only significant response occurred during years of above average rainfall. The dry matter production with N0, N75 and N150 kg/ha were respectively, 1 859; 2 192 and 2 339 kg/ha. This poor response to N can partially be attributed to a significant ( $P < 0,05$ ) N x P interaction. On average *A. pubescens* produced 1,6; 1,8; 1,9; 1,9; 1,9; 2,3; 2,3; 2,5 and 2,8 ton OM/ha at treatment levels of N0P0, N75P0, N150P0, N0P10, N0P20, N75P10, N150P10, N75P20 and N150P20, respectively. This interaction is related to the initial low soil content (0 to 1 mg/kg) and probably the fixation of a portion of the phosphate fertiliser by the soil.

According to other studies *A. pubescens* requires a soil P level of 12 mg/kg soil for optimum production. In order to reach this level in the Mangano series within five years, 24 kg P/ha is required annually. An additional 7 kg P/ha is required annually as maintenance. Therefore a P fertiliser level of 31 kg/ha should be applied annually to the Mangano series for five years, whereafter probably only 7 kg P/ha is required.

The influence of K on the dry matter production of *A. pubescens* was small. The average dry matter production were 2 052, 2 161 and 2 177 kg/ha at fertiliser levels of 0, 75 and 150 kg K/ha, respectively. The water soluble and exchangeable K content of the top and sub-soil remained virtually constant, although *A. pubescens* absorbed large quantities of K (c. 83 kg K/ha/a). Evidently, the Mangano series has a substantial K reserve and K fertilisation should not be necessary over the short and medium term (c. 10 years).

The mean crude protein content of plant material harvested in summer (10% flowering stage) and winter (mature stage) were respectively, 8,4 and 6,8%, with a variation of between 4,6 and 11,2% over the experimental period.

The mean P content of phytomass sampled in winter and summer was 0,14 and 0,24%, respectively, with a variation of between 0,07 and 0,44% over the experimental period.

The Zn content of plant material declined during the course of the trial. This tendency may be attributed to a drop in the Zn content of the soil from 1,83 to 0,76 mg Zn/kg soil. Taking into account the rate of Zn absorption by *A. pubescens*, an annual Zn fertiliser rate of 2 kg/ha should be adequate.

## Summer rain cropping areas

### CULTIVATED PASTURE

#### MANAGEMENT

#### THE INFLUENCE OF STOCKING RATE AND FERTILISATION ON THE SUMMER PRODUCTION OF SMUTS FINGER GRASS AS CULTIVATED PASTURE IN THE SUMMER RAIN CROPPING AREAS. 1978-1984

R.H. Drewes

The relatively low mass gains obtained with Dohne Merino sheep on Smuts finger grass, can be ascribed primarily to the system of continuous grazing, applied in this experiment. It appeared that even during high rainfall years an artificial feed shortage developed amid the rank growth since the sheep simply concentrated on the previously grazed plants. This phenomenon was also apparent even in low rainfall years on the low stocking rate treatments.



The mass gains obtained varied from 60 to 178 kg/ha for the summer months. The optimum carrying capacity for this period is 12 SSU/ha.

Under the conditions of the relatively low rainfall experienced during three of the four years, it appeared that the lower fertiliser level (60 kg N + 10 kg P/ha) produced as much, in terms of mass gain/ha, as the higher level (120 kg N + 20 kg P/ha) of fertiliser application did. As a general guide, it would seem as if the lower level is adequate for Smuts finger grass as grazing during average and below normal rainfall years, whereas the higher level could be considered when above average rainfall conditions are experienced.

A higher production was also consistently obtained on the Avalon than on the Valsrivier soil form. The highest gross margin of R99/ha at the lower fertiliser level, was also obtained on the Avalon soil.

The *in vitro* digestibility of Smuts finger grass for the summer months varies from 60 to 65 %.

## CULTIVATED PASTURE

### MANAGEMENT

#### THE INFLUENCE OF STOCKING RATE AND TIME OF WINTER UTILISATION OF SMUTS FINGER GRASS AS CULTIVATED PASTURE IN THE SUMMER RAIN CROPPING AREAS. 1978-1983

R.H. Drewes

The results of this experiment were strongly influenced by the rainfall experienced during the preceding summer period during each of the respective seasons. The amount of rain varied from 714 mm during one season to as low as 446 mm during another. The herbage production consequently also varied from 1 600 kg/ha to 265 kg/ha after a wet or a dry year, respectively.

It appears from the results that a stocking rate (stocking density) of 8 SSU/ha during early winter (May/June) gave the highest mass gains for year-old Dohne Merinos, whereas the best results were obtained from a stocking rate of 16 SSU/ha during the latter part of winter (Aug./Sept.).

The mass gains of 25 kg/ha were relatively small, yet satisfactory if Smuts finger grass is seen as a foggage which is utilised mainly as a source of roughage for the winter period.

The *in vitro* digestibility of Smuts finger grass as foggage is 40-45 % and the crude protein content 4.5 %. A gross margin of R113/ha can be obtained from a system of utilising Smuts finger grass as foggage during winter and as a hay crop during summer.

## High rainfall sourveld areas

### VELD

### MANAGEMENT

#### VELD: STOCKING DENSITY AND SPECIES AND AREA SELECTION IN THE HIGH RAINFALL SOURVELD AREAS OF THE EASTERN CAPE. 1972-1978

T. Daines, R.A. Ingpen, L.G. Howe and L.O. Nel

This investigation was conducted at Dohne Agricultural Research Station (32° 34'S and 27° 23'E) to monitor grazing patterns and species selection of sheep and cattle grazing the multi-specific Dohne sourveld. Results show that cattle and sheep have a similar manner and pattern of harvesting the grass on offer. These results show that cattle and sheep are competitors for the same source of feed and are not complementary grazers. It is further shown that species preference plays a more important role in species selection than height of species in the utilisation of the species making up the sward. Increasing the stocking density does not change species preference or grazing pattern - it only results in the faster utilisation of the more preferred species. The necessity of grazing cattle and sheep in set ratios is queried from the biological aspect and it is suggested that sourveld could be utilised by sheep alone if a multi-camp system with top management is applied.

The use of grazing patterns and the strategies of veld management developed from this study have been tested in grazing trials using cattle alone and with a combination of cattle and sheep. The 12-camp grazing system managed according to these strategies has proved superior to the conventional 4-camp system managed according to the principles of open controlled selective grazing. Individual sheep and cattle production was respectively, 44% and 20% higher in the multi-camp system than in the conventional 4-camp system.

## **ENTREPRENEUR DEVELOPMENT**

### **PROGRAMMED EXTENSION: RESOURCES AND TECHNOLOGY**

#### **Bushveld areas**

##### **EXTENSION ORGANISATION**

##### **PERSUASION**

##### **THE DEVELOPMENT OF AN ORGANISATIONAL STRUCTURE TO PROMOTE OPTIMAL AGRICULTURAL DEVELOPMENT: THABAZIMBI EXTENSION WARD. 1981-1983**

**G.J.G. du Plooy**

The purpose of this facet was to motivate farmers to constitute an agricultural development committee, as well as administrative, economic and technical subcommittees for the different farming enterprises in the district.

The concept of agricultural development was discussed with organised agriculture and the Agricultural Development Committee (ADC) was formed consisting of the management committee of the District Agricultural Union and local directors of Co-operatives. The ADC identified problems in cattle and irrigation farming which were transferred to appropriate subcommittees to find solutions. The subcommittees consist of local farmers nominated by the ADC.

Evaluation of the process of developing the organisational structure showed that a sound basis was formed for future agricultural development. Whether this will happen, depends on how efficiently the subcommittees function in finding solutions to the problems identified and communicating these to the farmers.



## BOTANY

### BOTANY RESEARCH

#### Plant taxa

#### FLORA

#### TAXONOMY

PL.7111/01/1/1: FLORA OF SOUTHERN AFRICA: REGISTER OF NAMES AND TYPES  
FOR POACEAE. 1979-1985  
G.E. Gibbs-Russell

More than 4 200 scientific names that have been based on or applied to southern African grasses were located in the literature, and information about them has been entered in a computer data file so that all names needed for the taxonomic study of a particular genus can be listed when required. The information included in the computer entry for each name includes; complete scientific name, author, place and date of publication, synonym, cross-reference to other genera, and type specimen (where known). When this file was complete, all names were sorted by place of publication, thus making it possible to photocopy the original descriptions systematically for each reference. Many of these descriptions are contained in very old or rare publications that are normally difficult to obtain.

The most time-consuming part of taxonomic work is determining which names must be evaluated, locating the original descriptions and borrowing the type specimens. The availability of computerised listings of names and the ready access to photocopies of original descriptions will therefore result in significant time-saving by taxonomists engaged in research on grass genera for the *Flora of southern Africa*.

In comparing the Register for Poaceae to a similar compilation of validly published names accumulated by hand for the Mesembryanthemaceae, it has been found that in both plant families there are about 4 validly published names per taxon. There are over 24 000 taxa of plants in southern Africa. If each of these has 4 validly published names, then there could be as many as 96 000 names that must be evaluated through their type specimens during the course of research for the *Flora of southern Africa*. Therefore, the methods worked out for the efficient recording of scientific names for Poaceae can be applied to other plant families, in compiling the information about all validly published names for southern African plants that is necessary to complete the nomenclatural aspects of their taxonomic study as rapidly as possible.

#### FLORA

#### TAXONOMY

PL.7111/01/1/8: FLORA OF SOUTHERN AFRICA: FABACEAE-CAJANEAE. 1976-1985  
G. Germishuizen

The genus *Rhynchosia* is one of nearly 500 genera of the legume family Fabaceae, tribe Phaseoleae and subtribe Cajaneae. In South Africa the subtribe comprises six genera, namely *Cajanus*, *Bolusafra*, *Rhynchosia*, *Eriosema*, *Chrysoscias* and *Flemingia* with both *Bolusafra* and *Chrysoscias* being endemic to South Africa. The genera *Rhynchosia* and *Eriosema* are closely related to each other, but the problem of finding new characters for the separation of the two genera is not critical in South Africa since the species of *Rhynchosia*, with the exception of *R. villosa*, are not readily confused with those of *Eriosema*.

*Rhynchosia* is the most important genus of the subtribe Cajaneae, comprising some 300 species, cosmopolitan in tropical and subtropical regions. In southern Africa the genus *Rhynchosia* comprises some 70 species (not  $\pm$  80 as previously assumed), and these occur mainly as herbs or undershrubs, twining, prostrate or rarely erect, arising from a woody rootstock. The leaflets are three in number, sometimes only one (*R. monophylla*), but rarely five or more (*R. ferrulaefolia* and *R. pinnata*) and are glandular and dotted underneath (*R. adenodes*, *R. minima*, *R. resinosa* and *R. caribae*). Both the last-mentioned morphological features play an important role in the identification of the species. The species occur in various habitats, but mainly in grassland among rocks.

The genus *Chrysoscias*, with six species endemic to the Transvaal and south-western Cape, was found to be closely related to *Rhynchosia* and therefore, all the species of *Chrysoscias* have been included in *Rhynchosia*.

## Summaries

Nine species, namely *Rhynchosia pinnata*, *R. leucoscias*, *R. grandiflora*, *R. microscias*, *R. ferrualaefolia*, *R. ciliata*, *R. capensis*, *R. argentea* and *R. bullata*, are endemic to the eastern, southern and south-western regions of the Cape Province, whereas *R. vendae*, as the name implies, occurs only in Venda in the north-eastern Transvaal. *R. dinteri* and *R. namaensis* occur only in South West Africa/Namibia; and *R. ovata* only in Natal. *R. hirsuta*, *R. harveyi*, *R. galpinii*, *R. angulosa*, *R. rogersii*, *R. thorncroftii*, *R. komatiensis*, *R. pauciflora*, *R. holosericea*, *R. cooperi* and *R. calvescens* are all endemic to southern Africa but occur in more than one province.

The last definitive revision of the genus *Rhynchosia* was made by Baker in *Bothalia* 1: 113-138 (1921), but it is now out of date. As a result of this study, a number of new taxa have been discovered and must still be described.

Little is known about the medicinal properties of *Rhynchosia*, but the people of Venda use the rootstock of *R. vendae* as a remedy for coughs.

## FLORA

### TAXONOMY

PL.7111/01/1/10: FLORA OF SOUTHERN AFRICA: MALVACEAE. 1964-1985  
O.A. Leistner

The Malvaceae is represented in southern Africa by 21 genera and a total of 161 species. The family is characterised by the numerous anther filaments which are fused into a tube around the style, an almost always stellate-hairy indumentum and alternate leaves with palmate venation.

Eleven of these genera are covered by the present facet. A key was written to genera represented on the subcontinent. This key is based mainly on the following characters: style and stigmas, calyx, epicalyx, number of ovules and nature of the mericarps.

The biggest genus dealt with is *Abutilon*, which lacks an epicalyx and has fruits consisting of 5-40 undivided, laterally compressed, follicular mericarps. Within the region the genus comprises 20 species. The key to species is based largely on mericarp characters. The second largest genus dealt with is *Pavonia* with 13 species. This genus, of which most members have flowers resembling those of the genus *Hibiscus*, is distinguished from all the others in the region by having twice as many style-branches and stigmas as carpels. The key to species is based mainly on epicalyx, mericarp and leaf characters. Next is the genus *Sida* with eight species in the region of which several are pantropical weeds. The genus lacks an epicalyx and its fruit breaks up into 5-12, one-seeded, often 2-awned mericarps. Species are keyed out with the aid of especially mericarp, pubescence and pedicel characters.

Another genus comprising several widely distributed weeds is *Malva* with seven species in the region. Members of the genus have three epicalyx bracts which are free or sometimes partly fused with the base of the calyx and a fruit separating into 7-12 one-seeded, remiform, laterally flattened, indehiscent, awnless mericarps. The species are keyed out on the basis of leaf, petal and mericarp characters. *M. aegyptiaca*, common in the deserts of North Africa and the Near and Middle East, has only twice been found in the region, once in 1811 and once in recent years.

Three species of the genus *Lavatera* have become naturalised in the region. They are recognised by their three foliaceous epicalyx bracts which are connate at the base, fused with the base of the calyx and about as long as the calyx. The species can be distinguished by, amongst others, the shape of the epicalyx lobes.

The following four genera all have only one species in the region: *Wissadula*, which has 3-5 mericarps  $\pm$  divided transversally into 2 cells, but which has no epicalyx; *Modiola*, an introduced genus with 15-25 transversally septate mericarps, but with an epicalyx; *Althaea* with 6-10 epicalyx bracts connate at the base, and two or more ovules per locule, a genus comprising well known garden plants, represented by only one indigenous desert species; and *Anoda* without epicalyx, with blue flowers and with the lateral walls of the mericarp disintegrating, a genus represented by an introduced weed.

## FLORA

### TAXONOMY

PL.7111/01/1/12: FLORA OF SOUTHERN AFRICA: RANUNCULACEAE. 1977-1985  
D.J.B. Killick

The family Ranunculaceae in southern Africa consists of the following genera: *Anemone* (3 species);



*Knowltonia* ( 8 species); *Clematis* (2 species); *Clematopsis* (1 species); *Myosurus* (1 species); *Ranunculus* (6 species) and *Thalictrum* (2 species). A key to the genera has been produced based on habit, leaf position, inflorescence, presence of petals, sepal size and fruits.

The genus *Anemone* was revised and a key drawn up to the species. The correct name of the well-known *A. capensis* Lam. was found to be *A. tenuifolia* (L.f.) DC., the latter antedating the former by two years. The correct author citation of *A. fanninii* was found to be Harv. ex Mast. and not Harv. or Harv. ex Adlam as cited by previous workers. Harvey's publication of *A. fanninii* in his *Gen. S. Afr. Pl.* 2nd ed. 2 (1868) was a *nomen nudum* and hence did not constitute valid publication, and Adlam's contribution in *Gard. Chron.* 25: 425-426 (1886) was a note rather than a description plus provision of the type material. Masters supplied an acceptable description and a figure (*lc.* 432, Fig. 84).

Considerable basic research was done on the genus *Knowltonia* while the responsible officer was based at Kew. The information obtained was passed on to Dr H. Rasmussen, who later published a revision of the genus in *Opera Botanica* 53, 1-44 (1979) and who will contribute an account of the genus to the *Flora of Southern Africa*.

Intensive collecting of taxa belonging to the Ranunculaceae was done in the Natal Drakensberg and in eastern Lesotho.

## FLORA

### TAXONOMY

PL.7111/01/1/15: FLORA OF SOUTHERN AFRICA: REGISTER AND BIBLIOGRAPHY OF FRESHWATER ALGAE (CHLOROPHYCEAE). 1979-1985  
O.A. Leistner

All available literature on southern African Chlorophyceae, dating as far back as 1877, has been worked through and recorded on cards. For each species the following was tabulated: names, synonyms, references, material on which identification was based, collecting locality, collector and collecting number, institute where type is housed, description and, where relevant, author and reference in which the name is referred to.

Visits to several herbaria in South Africa, in Britain and on the Continent produced little additional information on type specimens. It is obvious that many algologists did not strictly follow the rules of nomenclature. In addition, collections were often poorly curated. Consequently, information is often incomplete or based largely or entirely on other references. The term *fide* has often been used in the register in order to cover the compiler and to draw the reader's attention to the fact that a given entry is based entirely on a certain literature source.

About half the material which has been put on cards has been typed in the final format.

**SCIENTIFIC ARTICLES**  
**WETENSKAPLIKE ARTIKELS**





## PLANT PRODUCTION PROMOTION/PLANTPRODUKSIE- BEVORDERING

### AGRONOMY RESEARCH/AKKERBOUNAVORSING

#### Summer grain/Somergraan

#### MAIZE/MIELIES

#### NUTRITION/VOEDING

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#### UPGRADING/VEREDELING

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## PESTS/PLAE

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## Small grain/Kleingraan

### WHEAT/KORING

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NAVORSING (GEWASSE)**

**Field crops/Landgewasse**

**SUMMER GRAIN/SOMERGRAAN**

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**Ruminants/Herkouers**

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**CROP SCIENCE/GEWASKUNDE**

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**Small grain/Kleingraan**

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- GG.2121/07/1/4: The genetic improvement of winter wheat for drought resistance. 1984. H.A. van Niekerk
- GG.2121/07/2/1: The evaluation of newly developed elite and imported dryland spring wheat lines. 1976. C.F. Marais
- GG.2121/07/2/2: The evaluation of all newly developed elite and introduced spring wheat lines. 1976. H.A. van Niekerk
- GG.2121/07/2/3: The genetic control of photoperiod/temperature sensitivity of wheat. 1978. P.B. le Grange
- GG.2121/07/3/1: Gene mapping of wheat chromosomes, using monosomic analysis. 1976. H.A. van Niekerk
- GG.2121/07/3/2: The influence of gamma rays on wheat gametophytes. 1976. H.A. van Niekerk
- GG.2121/07/4/1: The evaluation of wheat germ plasm. 1981. I.B.J. Smit
- GG.2121/07/4/2: The upkeep of unique wheat germ plasm. 1981. M. Streutker
- GG.2121/07/4/3: The development of a computerised data base for wheat germ plasm. 1983. F.M. Thatcher



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- GG.2121/07/5/2: Evaluation of the need for and desirability of early generation selection for grain quality characteristics in wheat. 1978. H.A. van Niekerk
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- GG.2121/07/5/6: The influence of nitrogen uptake and metabolism on grain quality of wheat lines. 1979. H.A. van Niekerk

#### PATHOLOGY/PATOLOGIE

- GG.2121/19/1/1: Occurrence and distribution of root-and-foot-rot disease in wheat. 1978. D.B. Scott
- GG.2121/19/1/2: Identity and pathogenecity of *Rhizoctonia* spp. associated with crater disease of wheat. 1980. D.B. Scott
- GG.2121/19/1/3: The influence of fertilisers and crop rotation on the occurrence of take-all (*Gaeumannomyces graminis* var. *tritici*) in irrigated wheat. 1983. E.M.C. Maas
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- GG.2121/19/1/5: Chemical control of root disease in wheat. 1982. E.M. Smith
- GG.2121/19/1/6: Observation on the occurrence of air-borne diseases of wheat in South Africa. 1980. Z.A. Pretorius
- GG.2121/19/2/2: Collection, maintenance and classification of wheat stem rust biotypes (*Puccinia graminis* f. sp. *tritici*). 1980. J. le Roux
- GG.2121/19/2/3: Collection, maintenance and classification of wheat leaf rust races (*Puccinia recondita* f. sp. *tritici*). 1980. Z.A. Pretorius
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- GG.2121/19/3/1: Observation on the occurrence of seed-borne diseases of wheat in South Africa. 1980. J. le Roux
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- GG.2121/20/1/2: Ecological studies on the Russian wheat aphid, *Diuraphis noxia* in the Eastern Free State. 1983. Y.K. Aalbersberg
- GG.2121/20/1/3: Seed treatment with systemic insecticides for the chemical control of the Russian wheat aphid, *Diuraphis noxia*. 1980. P.A. Butts

- GG.2121/20/1/4: Soil treatment with systemic insecticides for the chemical control of the Russian wheat aphid, *Diuraphis noxia*. 1980. F. du Toit
- GG.2121/20/1/5: Screening of wheat breeding material for resistance to the Russian wheat aphid, *Diuraphis noxia*. 1980. F. du Toit
- GG.2121/20/1/6: The economic importance of viruses transmitted by the Russian wheat aphid, *Diuraphis noxia* to wheat. 1984. F. du Toit
- GG.2121/20/1/7: The nature of the toxaemia in wheat caused by the Russian wheat aphid *Diuraphis noxia*. 1982. F. du Toit
- GG.2121/20/1/8: Aspects of the biology and ecology of the wheat aphid *Diuraphis noxia* in the South-western Orange Free State including preliminary studies on the oat aphid *Rhopalosiphum padi* and the dryland aphid *Schizaphis graminum*. 1980. F. du Toit
- GG.2121/20/1/9: The evaluation of wheat breeding material for resistance to the oat aphid *Rhopalosiphum padi* and the ear aphid *Sitobion avenae*. 1985. F. du Toit
- GG.2121/20/2/1: The occurrence and distribution of injurious soil insects in wheat. 1983. F. du Toit
- GG.2121/20/2/2: Chemical control of false wire worm (Tenebrionidae) in wheat with soil and seed treatment. 1984. F. du Toit
- GG.2121/20/3/1: Survey of eelworm species in the wheat-producing areas. 1983. S. Storey
- GG.2121/20/3/2: Pathogenecity of eelworm species to wheat (glasshouse study). 1984. S. Storey
- GG.2121/20/4/1: The occurrence and distribution of foliar pests of wheat in South Africa. 1985. F. du Toit

#### CROP SCIENCE/GEWASKUNDE

- GG.2121/30/1/1: Seed multiplication of wheat cultivars and lines in the winter rainfall area. 1983. E.J.G. Brand
- GG.2121/30/1/2: Seed multiplication of wheat cultivars and lines in the summer rainfall area. 1983. G.D. Joubert
- GG.2121/30/1/3: Seed multiplication of wheat cultivars and lines under irrigation. 1983. G.D. Joubert
- GG.2121/30/2/1: Wheat cultivar evaluation in the winter rainfall area. 1983. E.J.G. Brand
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- GG.2121/30/3/1: Determination of the optimum planting date and sowing rate of wheat cultivars in the winter rainfall area. 1983. E.J.G. Brand
- GG.2121/30/3/2: Determination of the optimum planting date and sowing rate of wheat cultivars in the summer rainfall area. 1983. G.D. Joubert
- GG.2121/30/3/3: Determination of the optimum planting date and sowing rate of wheat cultivars under irrigation. 1983. G.D. Joubert
- GG.2121/30/4/1: The influence of soil cultivation methods on the production ability of soil with wheat in the summer rainfall region. 1982. H.A. Smit
- GG.2121/30/4/2: The influence of stubble mulching on grain yield of wheat in the summer rainfall area. 1982. H.A. Smit
- GG.2121/30/5/1: The control of wild oats in wheat by means of a maize/wheat production system in the summer rainfall area. 1982. H.A. Smit
- GG.2121/30/6/1: The application of herbicides on different stages of wild oats in wheat in the winter rainfall area. 1982. H.A. Smit
- GG.2121/30/6/3: Phytotoxicity of wild oats and grass herbicides in promising wheat lines and new wheat cultivars in the winter rainfall region. 1982. H.A. Smit
- GG.2121/30/6/4: Phytotoxicity of wild oats and grass herbicides on promising wheat lines and new wheat cultivars in the summer rainfall area. 1982. H.A. Smit



- GG.2121/30/6/5: Germination of requirements and herbicide resistance of wild oats. 1984. H.A. Smit
- GG.2121/30/7/1: The efficiency of broad-leaf weed control of newly registered herbicides in wheat in the winter rainfall area. 1982. H.A. Smit
- GG.2121/30/7/2: Phytotoxicity of broad-leaf herbicides on promising wheat lines and new wheat cultivars in the winter rainfall area. 1982. H.A. Smit
- GG.2121/30/7/3: Phytotoxicity of broad-leaf herbicides on promising wheat lines and new wheat cultivars in the summer rainfall region. 1982. H.A. Smit
- GG.2121/30/8/1: The effect of wild oats competition on the grain yield of wheat in the Winter Rainfall Region. 1982. H.A. Smit

#### CHEMISTRY/CHEMIE

- GG.2121/53/1/1: Evaluation and refinement of routine quality analytical procedures on wheat. 1976. H.A. van Niekerk
- GG.2121/53/1/2: Upkeep of a protein laboratory for applied quantitative protein analytical procedures of wheat. 1976. H.A. van Niekerk
- GG.2121/53/1/3: The identification of wheat cultivars by means of prolamine electrophoresis profiles. 1980. H.A. van Niekerk

#### TRITICALE

##### UPGRADING/VEREDELING

- GG.2122/07/1/1: The evaluation of elite newly developed and introduced cultivars. 1976. W.H.C. Struwig
- GG.2122/07/2/1: The selection of meiotic stable breeding parents from advanced triticale lines. 1976. W.H.C. Struwig
- GG.2122/07/3/1: The evaluation of triticale germ plasm. 1981. I.B.J. Smit
- GG.2122/07/3/2: The upkeep of unique triticale germ plasm. 1981. M. Streutker
- GG.2122/07/3/3: The development of a computerised data base for unique triticale germ plasm. 1983. F.M. Thatcher

#### DURUM

##### NUTRITION/VOEDING

- GG.2123/05/1/1: Effect of nitrogen fertilisation on the production and quality of durum wheat under irrigation. 1982. W.H. Kilian

##### UPGRADING/VEREDELING

- GG.2123/07/1/1: The evaluation of elite newly developed and imported durum lines. 1976. H.A. van Niekerk
- GG.2123/07/2/1: The evaluation of durum germ plasm. 1981. I.B.J. Smit
- GG.2123/07/2/2: The upkeep of unique durum germ plasm. 1981. M. Streutker
- GG.2123/07/2/3: The development of a computerised data base for durum production. 1983. F.M. Thatcher
- GG.2123/07/3/1: The quality evaluation of all newly developed durum lines. 1976. H.A. van Niekerk

#### BARLEY/GARS

##### PHYSIOLOGY/FISIOLOGIE

- GG.2124/03/1/1: Determination of factors which cause black end coloration to barley in the winter rainfall area. 1982. E.J.G. Brand

## UPGRADING/VEREDELING

- GG.2124/07/1/1: The breeding of barley and evaluation of elite newly developed and imported cultivars. 1976. P.B. le Grange
- GG.2124/07/2/1: The evaluation of barley germ plasm. 1981. I.B.J. Smit
- GG.2124/07/2/2: The upkeep of unique barley germ plasm. 1981. M. Streutker
- GG.2124/07/2/3: The development of a computerised data base for barley germ plasm. 1983. F.M. Thatcher
- GG.2124/07/3/1: Quality evaluation of all new barley lines for brewing characteristics. 1976. H.A. van Niekerk

## CROP SCIENCE/GEWASKUNDE

- GG.2124/30/1/1: Seed multiplication of elite barley lines and cultivars in the winter rainfall area. 1982. E.J.G. Brand
- GG.2124/30/1/2: Seed multiplication of the elite barley lines and cultivars in the summer rainfall area. 1982. G.D. Joubert
- GG.2124/30/2/1: Determination of the optimum planting date and sowing rate of barley cultivars in the winter rainfall area. 1983. E.J.G. Brand
- GG.2124/30/3/1: Leaf number/apex development stage relationship of barley in the winter rainfall area as influenced by chemical weedicides. 1982. H.A. Smit
- GG.2124/30/3/2: Phytotoxicity of wild oat herbicides on barley in the winter rainfall area. 1982. H.A. Smit
- GG.2124/30/3/3: Phytotoxicity of herbicides on promising barley lines and new barley cultivars in the summer rainfall area. 1982. H.A. Smit
- GG.2124/30/3/4: The determination of the apex development stages of barley for the safe application of hormone type herbicides in the summer rainfall area. 1982. H.A. Smit

## RYE/ROG

### UPGRADING/VEREDELING

- GG.2125/07/1/1: The evaluation of elite newly bred and imported rye lines. 1976. G.F. Marais
- GG.2125/07/2/1: The evaluation of germ plasm. 1981. I.B.J. Smit
- GG.2125/07/2/2: The upkeep of unique rye germ plasm. 1981. M. Streutker
- GG.2125/07/2/3: The development of a computerised data base for unique rye germ plasm. 1983. F.M. Thatcher

## OATS/HAWER

### UPGRADING/VEREDELING

- GG.2126/07/1/1: The evaluation of elite newly developed oat lines and introductions. 1976. M. Streutker
- GG.2126/07/2/1: The evaluation of oat germ plasm. 1981. I.B.J. Smit
- GG.2126/07/2/2: The upkeep of unique oat germ plasm. 1981. M. Streutker
- GG.2126/07/2/3: The development of a computerised data base for oat germ plasm. 1983. F.M. Thatcher

## CROP SCIENCE/GEWASKUNDE

- GG.2126/30/1/1: The multiplication of elite oat lines in the winter rainfall area. 1982. E.J.G. Brand



- GG.2126/30/1/2: Seed multiplication of elite oat lines in the summer rainfall area. 1982. G.D. Joubert
- GG.2126/30/2/1: Determination of the optimum planting date and sowing rate of oat cultivars in the winter rainfall area. 1982. E.J.G. Brand
- GG.2126/30/2/2: Determination of optimum planting date and sowing rate of oat cultivars in the summer rainfall area. 1982. G.D. Joubert
- GG.2126/30/3/1: The determination of the safe apex development stages of oat for the application of hormone type herbicides in the summer rainfall area. 1982. H.A. Smit

### Protein and oil seeds/Proteien- en oliesade

#### GROUNDNUTS/GRONDBONE

#### PHYSIOLOGY/FISIOLOGIE

- GG.2131/03/2/1: The influence of varying temperatures on the gynophore and pod set of groundnuts. 1983. J. Dreyer
- GG.2131/03/3/1: Drying characteristics of groundnuts. 1983. W. Jansen

#### NUTRITION/VOEDING

- GG.2131/05/1/1: NPK fertiliser studies with groundnuts. 1983. H.L. Loubser
- GG.2131/05/1/2: The influence of boron and calcium fertilisation on mould contamination of groundnuts. 1984. C.J. Swanevelder
- GG.2131/05/1/3: Calcium fertilisation of groundnuts. 1985. C.J. Swanevelder

#### PATHOLOGY/PATOLOGIE

- GG.2131/19/1/1: Fusarium diseases of dryland cultivated groundnuts. 1985. S.H. Swart
- GG.2131/19/2/1: *Macrophomina* infections on groundnuts. 1985. E.L. Holtzhausen
- GG.2131/19/3/1: The influence of groundnut root and pod exudates on *Chalara elegans*. 1984. J.R. Anderson
- GG.2131/19/3/2: The influence of groundnut rhizosphere micro-organisms in controlling/stimulating *Chalara elegans* infestation. 1984. J.R. Anderson
- GG.2131/19/3/3: Interactions between *Chalara elegans* and saprophytic or ecto-parasitic nematodes in the dissemination of the disease (black hull) on groundnuts. 1984. J.R. Anderson
- GG.2131/19/3/4: Method of entry of *Chalara elegans* into groundnut tissue. 1984. J.R. Anderson
- GG.2131/19/3/5: Development of reproducible and accurate method for enumerating spores of *Chalara elegans* in groundnuts, soils and plant debris. 1984. J.R. Anderson
- GG.2131/19/3/6: Laboratory studies on the nutritional requirements and biochemical pathways of *Chalara elegans* as found on groundnuts. 1984. J.R. Anderson
- GG.2131/19/3/7: Laboratory and greenhouse preliminary screens on groundnuts for biocides active against *Chalara elegans*. 1984. J.R. Anderson
- GG.2131/19/3/8: Developing of laboratory-greenhouse method for testing groundnut genotypes for resistance to *Chalara elegans*. 1983. B.L. Jones
- GG.2131/19/3/9: The use of crop rotations in controlling *Chalara elegans* in groundnuts. 1983. B.L. Jones
- GG.2131/19/3/10: Survey of naturally occurring *Chalara elegans* in the groundnut production areas of the RSA.
- GG.2131/19/3/11: Biological control of *Chalara elegans* in groundnuts. 1982. J.R. Anderson
- GG.2131/19/3/12: Pathogenicity studies with *Chalara elegans* of groundnuts. 1982. C.L.E. Labuschagne

## PESTS/PLAE

GG.2131/20/1/1: *Hilda patruelis* and mould on groundnuts. 1984. C.J. Swanevelder

## CROP SCIENCE/GEWASKUNDE

GG.2131/30/2/2: Ridge planting of groundnuts for limiting black hull. 1982. J. Dreyer

GG.2131/30/2/3: Harvesting techniques and mould contamination of groundnuts. 1985. C.J. Swanevelder

GG.2131/30/2/4: The influence of harvesting and picking dates on mould contamination of groundnuts. 1984. C.J. Swanevelder

GG.2131/30/2/5: Basin tillage in groundnut production. 1984. E.B. Birch

GG.2131/30/3/1: The influence of planting date on runner type groundnuts. 1985. C.J. Swanevelder

GG.2131/30/4/1: Determining the effect of nut grass, *Cyperus* spp. on the yield of groundnuts. 1982. A.P.J. de Beer

GG.2131/30/4/2: The effect of Dinitroanilin herbicide on the growth and development of the runner type groundnuts. 1983. A.P.J. de Beer

GG.2131/30/5/1: The influence of mulching on mould contamination of groundnuts. 1984. C.J. Swanevelder

## SUNFLOWERS/SONNEBLOMME

### PHYSIOLOGY/FISIOLOGIE

GG.2132/03/1/1: Study on effect of environmental factors on growth, development and yield of sunflower. 1982. R.N. de Vos

### NUTRITION/VOEDING

GG.2132/05/1/1: The nitrogen, phosphorus and potassium requirements of sunflowers. 1981. H.L. Loubser

GG.2132/05/1/2: The response of sunflowers to different rates of nitrogen and phosphorus as influenced by liming. 1981. H.L. Loubser

GG.2132/05/1/3: The evaluation of leaf analysis as a diagnostic technique in sunflower nutrition. 1981. H.L. Loubser

GG.2132/05/1/4: The effect of mycorrhiza on the utilisation of phosphorus by sunflowers. 1985. H.L. Loubser

### UPGRADING/VEREDELING

GG.2132/07/1/2: The breeding of sunflower restorer lines and composites for utilisation in hybrid breeding. 1974. B.C. Greyling

GG.2132/07/1/3: The breeding of sunflower A/B lines and composites for utilisation in hybrid breeding. 1974. W.J. Vermeulen

### PATHOLOGY/PATOLOGIE

GG.2132/19/1/1: *Macrophomina* infections of sunflower. 1985. E.L. Holtzhausen

GG.2132/19/2/1: Bacterial stalk rot of sunflower. 1985. L. van der Walt

## PESTS/PLAE

GG.2132/20/1/1: The identification of the nematodes associated with sunflower. 1984. C. Bolton

## Registered projects/Geregistreeerde projekte

- GG.2132/20/1/2: The optimal environmental conditions predisposing the attack of the most important nematode species on sunflower. 1984. C. Bolton

### CROP SCIENCE/GEWASKUNDE

- GG.2132/30/1/2: The ability of sunflower cultivars to compensate for low plant populations. 1983. H.L. Loubser
- GG.2132/30/1/3: The ability of sunflower cultivars and breeding lines to emerge at high temperatures. 1983. H.L. Loubser
- GG.2132/30/1/4: Reaction of sunflower cultivars on varying levels of soil acidity. 1982. J. Chapman
- GG.2132/30/2/1: Basin tillage in sunflower production. 1984. E.B. Birch
- GG.2132/30/2/2: Row spacing on basin tillage in sunflower production. 1985. E.B. Birch
- GG.2132/30/2/3: Weed control for basin tillage in sunflower production. 1985. E.B. Birch
- GG.2132/30/2/4: Infiltration rate of sunflower soils. 1985. E.B. Birch
- GG.2132/30/2/5: Run-off on sunflower soils. 1985. E.B. Birch
- GG.2132/30/2/6: Mulch period and level on sunflower production. 1985. E.B. Birch
- GG.2132/30/2/7: Millet mulching in sunflower production. 1985. E.B. Birch
- GG.2132/30/2/8: Mulch crops in sunflower production. 1985. E.B. Birch

### MODELLING/MODELLERING

- GG.2132/42/1/1: Predicting of the effect of nitrogen fertilisation and moisture supply on the yield of sunflowers. 1985. H.L. Loubser

## SOYBEANS/SOJABONE

### PHYSIOLOGY/FISIOLOGIE

- GG.2133/03/1/1: The effect of planting date on the response of soybean cultivars at different plant populations. 1983. J. Chapman

### NUTRITION/VOEDING

- GG.2133/05/1/1: The interaction of lime on nitrogen, phosphorus and potassium fertilisation on soybeans. 1983. J. Chapman
- GG.2133/05/1/2: The determination of critical values for soil phosphorus with soybeans. 1983. J. Chapman

### UPGRADING/VEREDELING

- GG.2133/07/1/1: Evaluation of soybean lines/introductions for use as commercial cultivars and/or as parents in a breeding programme. 1983. T.E.M. Odendaal
- GG.2133/07/1/2: The selection and generation of segregating material. 1984. T.E.M. Odendaal

### CROP SCIENCE/GEWASKUNDE

- GG.2133/30/1/1: Evaluation of soybean cultivars in different production areas. 1978. J.N.H. Lemmer
- GG.2133/30/1/3: Tolerance of soybean, sunflower and dry bean cultivars to Al toxicity. 1982. J. Dreyer
- GG.2133/30/1/4: Genotype x environment interactions on yield tests and the application to a soybean breeding programme. 1984. T.E.M. Odendaal
- GG.2133/30/1/5: Response of soybean cultivars to aluminium under field conditions. 1982. J. Chapman
- GG.2133/30/2/1: Basin tillage in soybean production. 1984. E.B. Birch



DRY BEANS/DROëBONE

NUTRITION/VOEDING

- GG.2134/05/1/1: The effect of nitrogen application levels at different growth stages of dry beans. 1983. A.J. Liebenberg

UPGRADING/VEREDELING

- GG.2134/07/1/3: The breeding of dry beans for the packaging trade. 1983. B.R. Edington

PATHOLOGY/PATOLOGIE

- GG.2134/19/1/1: The production of disease-free dry bean (*Phaseolus vulgaris*) seed at Lutzville and Burgershall. 1977. A.J. Liebenberg
- GG.2134/19/1/2: The production of disease-free dry bean (*Phaseolus coccineus*) seed. 1984. A.J. Liebenberg
- GG.2134/19/1/3: Production of disease-free dry bean seeds via meristem and other *in vitro* culturing methods. 1985. P.C.W. van der Walt
- GG.2134/19/2/1: Survey of fungal diseases on dry bean roots in the summer rainfall regions of South Africa. 1985. S.H. Swart
- GG.2134/19/2/2: Survey of fungal diseases on the pods of dry beans in the summer rainfall regions of South Africa. 1985. S.H. Swart
- GG.2134/19/2/3: Survey of fungal diseases on dry bean leaves in the summer rainfall regions of South Africa. 1985. S.H. Swart
- GG.2134/19/3/1: Macrophomina infections of dry beans. 1985. E.L. Holtzhausen
- GG.2134/19/4/1: Halo blight of dry beans. 1985. L. van der Walt
- GG.2134/19/4/2: Common blight (*Xanthomonas phaseoli*) of dry beans. 1985. L. van der Walt

CROP SCIENCE/GEWASKUNDE

- GG.2134/30/1/2: The determination of the compensation ability of dry bean cultivars under varying plant densities. 1983. A.J. Liebenberg
- GG.2134/30/1/3: The evaluation of dry bean cultivars and breeding lines for drought resistance. 1983. A.J. Liebenberg
- GG.2134/30/1/4: The evaluation of the International Bean Yield and Adaptation Nursery (IBYAN) of CIAT. 1983. A.J. Liebenberg
- GG.2134/30/1/5: The evaluation of the International Bean Rust Nursery (IBRN) of CIAT. 1983. A.J. Liebenberg
- GG.2134/30/1/6: Effect of temperature on the vegetative and reproductive development of some South African dry bean (*Phaseolus vulgaris*) cultivars. 1983. E.D. Lloyd
- GG.2134/30/1/7: Response of bean cultivars on different soil acidity levels to determine aluminium tolerance. 1982. J. Chapman
- GG.2134/30/1/8: Effect of herbicides on the growth and development of different dry bean (*Phaseolus vulgaris*) cultivars. 1983. A.P.J. de Beer
- GG.2134/30/1/9: Tolerance of soybean, sunflower and dry bean cultivars to Al toxicity. 1982. J. Dreyer
- GG.2134/30/2/1: The influence of planting date on dry bean cultivars under different soil moisture levels. 1983. A.J. Liebenberg

## LUPINS/LUPIENE

### PHYSIOLOGY/FISIOLOGIE

- GG.2135/03/1/1: A study on the effect of daylength and temperature on the growth and development on *Lupinus albus*, *Lupinus mutabilis* and other lupin species. 1985. J.A.M. van der Mey
- GG.2135/03/2/1: A survey on the occurrence of different alkaloids in lupin species and lines for the summer rainfall areas. 1985. J.A.M. van der Mey
- GG.2135/03/2/2: Testing for seed coat hardness in lupin species and lines for the summer rainfall areas. 1985. J.A.M. van der Mey

### NUTRITION/VOEDING

- GG.2135/05/1/1: The influence of fertiliser placement on germination, growth, development and seed yield of lupins. 1985. H.L. Loubser
- GG.2135/05/1/2: The influence of soil and pH on the growth, development and yielding of lupins in the summer rainfall area. 1985. H.L. Loubser
- GG.2135/05/1/3: Plant nutritional studies on lupins with macro-elements in the summer rainfall areas. 1985. H.L. Loubser
- GG.2135/05/1/4: Plant nutritional studies with micro-elements on lupins in the summer rainfall areas. 1985. H.L. Loubser

### UPGRADING/VEREDELING

- GG.2135/07/1/1: The development of high yielding, adapted, alcaloid-free lupin cultivars of *Lupinus albus*, *Lupinus mutabilis* and other lupin species. 1985. J.A.M. van der Mey
- GG.2135/07/1/2: The development of high yielding alcaloid-free lupin cultivars by ionic radiation and chemical mutagens.

### PATHOLOGY/PATOLOGIE

- GG.2135/19/1/1: Survey of root diseases on lupins in the summer rainfall region of South Africa. 1985. D.E. Malan
- GG.2135/19/1/2: Survey of leaf and pod diseases on lupins in the summer rainfall area. 1985. D.E. Malan
- GG.2135/19/1/3: Survey of stem diseases of lupins in the summer rainfall area of South Africa. 1985. D.E. Malan
- GG.2135/19/2/1: Macrophomina infection of lupins. 1985. E.L. Holtzhausen
- GG.2135/30/1/1: Lupin cultivar evaluation in different production areas of the summer rainfall area. 1985. J.A.M. van der Mey
- GG.2135/30/2/1: Determination of optimal planting times for different lupin production areas in the summer rainfall areas. 1985. J.A.M. van der Mey
- GG.2135/30/2/2: Determination of optimal population density of lupins for the different production areas in the summer rainfall regions. 1985. J.A.M. van der Mey
- GG.2135/30/3/1: Determination of sensitivity of lupin cultivars and breeding lines to chemical weedkillers in the summer rainfall areas. 1985. A.P.J. de Beer
- GG.2135/30/3/2: Control of broad-leaf weeds in lupin plantings in the summer rainfall areas. 1985. A.P.J. de Beer
- GG.2135/30/3/3: Control of grasses and grass-like weeds in lupin plantings in the summer rainfall areas. 1985. A.P.J. de Beer

**Other agronomic crops/Ander akkerbougewasse**

**COTTON/KATOEN**

**NUTRITION/VOEDING**

- TK.2141/05/1/1: Response of cotton to nitrogen application with petiole analyses as diagnostic aid. 1980. M.C. Dippenaar
- TK.2141/05/1/2: Long-term NPK fertiliser study with cotton. 1972. M.C. Dippenaar
- TK.2141/05/1/3: Influence of mutual relation among nutrient elements in the soil and in cotton plants on the yield potential. 1983. N.J.J. Combrink
- TK.2141/05/1/4: Reaction of cotton to K:Ca:B ratios in pot experiments. 1983. N.J.J. Combrink

**UPGRADING/VEREDELING**

- TK.2141/07/1/1: Cotton breeding and selection. 1974. H.G. van Heerden
- TK.2141/07/1/2: Introduction of cotton-breeding lines and cultivars from abroad. 1974. H.G. van Heerden
- TK.2141/07/1/3: Back crossings with cotton. 1963. H.G. van Heerden
- TK.2141/07/2/1: Evaluation of cotton-breeding lines. 1960. H.G. van Heerden
- TK.2141/07/2/2: National cotton cultivar trials. 1975. H.G. van Heerden
- TK.2141/07/2/3: Recovery of cotton-breeding lines after a period of moisture or temperature stress. 1983. H.G. van Heerden

**PATHOLOGY/PATOLOGIE**

- TK.2141/19/1/1: Occurrence of different races of *Xanthomonas malvacearum* on cotton in South Africa. 1983. G.A. Schnippenkoetter

**PESTS/PLAE**

- TK.2141/20/1/1: Control of nematodes in cotton. 1982. R.J. van Wyk
- TK.2141/20/1/2: Survey and identification of parasitic nematodes in different cotton-producing areas. 1982. G.C. Prinsloo
- TK.2141/20/2/1: Factors which affect the control of *Tetranychus cinnabarinus* with local systemic miticides. 1983. M.F. Herholdt

**CROP SCIENCE/GEWASKUNDE**

- TK.2141/30/1/1: Application of growth regulators on cotton. 1981. M.C. Dippenaar
- TK.2141/30/1/2: Mulching and cultivation practices for cotton. 1983. G.S.P. Vink
- TK.2141/30/2/1: Chemical defoliation of cotton. 1982. M.C. Dippenaar

**WATER REQUIREMENTS/WATERBEHOEFTE**

- TK.2141/31/1/1: Influence of moisture deficits during different growth stages. 1977. W.J.J. Roux
- TK.2141/31/1/2: Effect of moisture deficits on different cotton cultivars and breeding lines. 1982. M.C. Dippenaar
- TK.2141/31/2/1: Irrigation practices for establishing seedlings. 1976. W.J.J. Roux



TOBACCO/TABAK

NUTRITION/VOEDING

- TK.2142/05/1/1: Nitrogen indices for and nitrogen supply of the Arcadia soil series for tobacco. 1972. H.J. Boshoff
- TK.2142/05/1/2: Influence of different sources of nitrogen on the yield and quality of flue-cured tobacco. 1981. H.J. Boshoff
- TK.2142/05/1/3: Trace-element nutrition of tobacco. 1973. H.J. Boshoff
- TK.2142/05/1/4: Relationship between nutrient element status of soils and the yield and composition of tobacco. 1973. G.L. le M. Passanah
- TK.2142/05/1/5: Chlorine in the soil, irrigation water and tobacco in the Hartebeespoort-Crocodile River irrigation area. 1979. F.J. Shawe
- TK.2142/05/1/6: Potassium nutrition of tobacco. 1980. H.J. Boshoff
- TK.2142/05/1/7: Magnesium nutrition of tobacco. 1980. H.J. Boshoff
- TK.2142/05/1/8: Determination of lime requirement for tobacco soils. 1983. E.A. Davies

UPGRADING/VEREDELING

- TK.2142/07/1/1: Determination of breeding value of flue-cured tobacco. 1964. M.P. Lamprecht
- TK.2142/07/1/2: Determination of breeding value of dark air-cured tobacco. 1964. A.M. Esterhuizen
- TK.2142/07/1/3: Determination of breeding value of light air-cured tobacco. 1967. A.P.F. Cornelissen
- TK.2142/07/1/4: Determination of breeding value of burley tobacco. 1969. A. van der Spoel
- TK.2142/07/1/5: Determination of breeding value of Oriental tobacco. 1969. M.P. Lamprecht
- TK.2142/07/1/6: Utilisation of haploid plants in tobacco breeding. 1976. A. van der Spoel
- TK.2142/07/1/7: Inbreeding of the male sterility factor in some *Nicotiana tabacum* cultivars. 1956. A.P.F. Cornelissen
- TK.2142/07/1/8: Breeding of *Nicotiana tabacum* cultivars resistant to diseases. 1952. M.P. Lamprecht
- TK.2142/07/1/9: Breeding of *Nicotiana tabacum* cultivars resistant to root knot nematodes. 1956. A.P.F. Cornelissen
- TK.2142/07/1/10: Cytogenetic study of the *N. tabacum* x *N. rustica* hybrid. 1981. A. van der Spoel
- TK.2142/07/1/11: Utilisation of *N. repanda* as source of root knot and disease resistance. 1981. A.M. Esterhuizen
- TK.2142/07/2/1: Evaluation of flue-cured tobacco-breeding lines. 1966. M.P. Lamprecht
- TK.2142/07/2/2: Evaluation of dark air-cured tobacco-breeding lines. 1966. A.M. Esterhuizen
- TK.2142/07/2/3: Evaluation of light air-cured tobacco-breeding lines. 1966. A.P.F. Cornelissen
- TK.2142/07/2/4: Evaluation of burley tobacco-breeding lines. 1966. A. van der Spoel
- TK.2142/07/2/5: Evaluation of Oriental tobacco-breeding lines. 1958. W.J.C. van der Merwe

PATHOLOGY/PATOLOGIE

- TK.2142/19/1/1: Interaction between *Phytophthora nicotianae* var. *nicotianae* and other soil inhabiting organisms in tobacco soils. 1973. G.C. Prinsloo
- TK.2142/19/1/2: Influence of crop rotation on the black shank organism of tobacco. 1977. D.A. de Villiers
- TK.2142/19/1/3: Chemical control of black shank in tobacco. 1980. G.C. Prinsloo
- TK.2142/19/1/4: Alternative hosts of the black root rot organism of tobacco. 1980. D.A. de Villiers

## Registered projects/Geregistreeerde projekte

- TK.2142/19/1/5: Chemical control of black root rot in tobacco. 1980. G.C. Prinsloo
- TK.2142/19/1/6: Involvement of *Fusarium* in the black shank complex on tobacco. 1983. M.C. Engelbrecht
- TK.2142/19/2/1: Tomato spotted wilt in tobacco. 1981. L.L. Vorster
- TK.2142/19/2/2: Potato virus Y in tobacco. 1981. L.L. Vorster
- TK.2142/19/2/3: Bushy top disease of tobacco. 1981. R.J. van Wyk

### PESTS/PLAE

- TK.2142/20/1/1: Chemical control of the cigarette beetle in tobacco warehouses. 1969. E.G. Eulitz
- TK.2142/20/1/2: Effectiveness of chemical control agents applied on different surface-covering materials for the control of cigarette beetles. 1974. E.G. Eulitz
- TK.2142/20/1/3: Chemical control of bollworms on tobacco. 1973. E.G. Eulitz
- TK.2142/20/1/4: Chemical control of aphids on tobacco. 1980. E.G. Eulitz
- TK.2142/20/2/1: Control of nematodes in tobacco. 1961. R.J. van Wyk
- TK.2142/20/2/2: Fluctuation of nematode population in different soil types. 1978. S.M. Claassen
- TK.2142/20/2/3: Survey and identification of parasitic nematodes in different tobacco-producing areas. 1981. S.M. Claassen
- TK.2142/20/2/4: Determination of threshold levels and infestation techniques for different soil types. 1981. S.M. Claassen

### CHEMICAL CONTROL/CHEMIESE BEHEER

- TK.2142/21/1/1: Chemical weed control in flue-cured tobacco plantings. 1968. M.P. Lamprecht
- TK.2142/21/1/2: Chemical weed control in Oriental tobacco plantings. 1980. W.J.C. van der Merwe

### CROP SCIENCE/GEWASKUNDE

- TK.2142/30/1/1: Spacing and topping of flue-cured tobacco. 1966. M.P. Lamprecht
- TK.2142/30/1/2: Spacing and topping of dark air-cured tobacco. 1966. M.P. Lamprecht
- TK.2142/30/1/3: Spacing and topping of light air-cured tobacco. 1966. M.P. Lamprecht
- TK.2142/30/1/4: Spacing and topping of burley tobacco. 1966. M.P. Lamprecht
- TK.2142/30/1/5: Spacing and topping of Oriental tobacco. 1966. W.J.C. van der Merwe
- TK.2142/30/1/6: Chemical control of suckers on tobacco. 1968. M.P. Lamprecht
- TK.2142/30/1/7: Cultivation of tobacco directly following wheat under irrigation. 1976. M.P. Lamprecht

### WATER REQUIREMENTS/WATERBEHOEFTE

- TK.2142/31/1/1: Influence of flood and sprinkle irrigation on the yield and quality of flue-cured tobacco. 1968. W.J.J. Roux
- TK.2142/31/1/2: Irrigation practices for establishment of seedlings. 1976. W.J.J. Roux

### TECHNOLOGY/TEGNOLOGIE

- TK.2142/52/1/2: Yield losses in the field during reaping, curing and grading of flue-cured tobacco. 1979. J.G. Nel
- TK.2142/52/1/3: Curing of air-cured tobacco. 1981. J.G. Nel
- TK.2142/52/1/4: Fermentation of air-cured tobacco. 1981. J.G. Nel

**CHEMISTRY/CHEMIE**

- TK.2142/53/1/1: Factors responsible for slick or putty tobacco. 1978. J.G. Nel  
TK.2142/53/1/2: Factors responsible for red-sponged tobacco. 1978. J.G. Nel  
TK.2142/53/1/3: Factors responsible for flat leaf and grain in flue-cured tobacco. 1981. J.G. Nel  
TK.2142/53/2/1: Determination of individual alkaloids in tobacco. 1981. J.G. Nel  
TK.2142/53/2/2: Nornicotine status of flue-cured tobacco-breeding lines. 1981. J.G. Nel  
TK.2142/53/2/3: Chemical changes during growth and curing of flue-cured tobacco. 1976. J.G. Nel  
TK.2142/53/2/4: Physical and chemical characteristics of tobacco grades. 1978. J.G. Nel  
TK.2142/53/3/1: Residues of insecticides in tobacco. 1969. E.G. Eulitz  
TK.2142/53/3/2: Residues of fungicides in tobacco. 1969. E.G. Eulitz

**SUNDRY AGRONOMIC CROPS/DIVERSE AKKERBOU GEWASSE**

**CROP SCIENCE/GEWASKUNDE**

- GG.2143/30/1/1: Introduction of rice-breeding material. 1980. J.J. Coetzee  
GG.2143/30/1/2: Evaluation of cultivars for agricultural value and adaptability. 1980. J.J. Coetzee

**CHICORY/SIGOREI**

**NUTRITION/VOEDING**

- D.2144/05/1/1: The fertilisation of chicory on an Oakleaf Limpopo. 1981. R.S. Marr

**UPGRADING/VEREDELING**

- D.2144/07/1/1: The selection of chicory. 1975. R.S. Marr

**CROP SCIENCE/GEWASKUNDE**

- D.2144/30/1/1: Chicory seed production. 1975. R.S. Marr  
D.2144/30/1/2: The chemical control of weeds in chicory. 1975. R.S. Marr  
D.2144/30/1/3: Planting and harvesting data for chicory on an Oakleaf Limpopo. 1980. R.S. Marr  
D.2144/30/1/4: The influence of preceding crops on the yield of chicory. 1980. R.S. Marr  
D.2144/30/1/5: The evaluation of chicory cultivars. 1975. R.S. Marr

**HORTICULTURE RESEARCH/TUINBOUNAVORSING**

**Tuber crops/Knolgewasse**

**POTATOES/AARTAPPELS**

**PHYSIOLOGY/FISIOLOGIE**

- TB.2411/03/1/1: The influence of calcium on the cell wall and cell structure of potato tubers. 1983. Marianne W. Venter  
TB.2411/03/1/2: Physiological studies regarding factors influencing tuber initiation of potatoes. 1978. B.J. Pieterse



## Registered projects/Geregistreeerde projekte

- TB.2411/03/2/1: *In vitro* storage techniques of disease-free mother material of potatoes. 1983. J.L.F. Dutrieux
- TB.2411/03/2/4: Anther culture as a technique in the upgrading of potatoes. 1983. M.H. Crespo
- TB.2411/03/3/1: Tolerance of potato cultivars to pre-emergence treatment with herbicides. 1983. F. du Plooy

## NUTRITION/VOEDING

- TB.2411/05/1/4: The influence of calcium on potatoes. 1984. M.W. Venter
- TB.2411/05/1/5: The influence of different methods and times of nitrogen fertilisation on potato production. 1981. K.P. Prinsloo
- TB.2411/05/1/6: Influence of calcium on potatoes. 1984. M.W. Venter

## UPGRADING/VEREDELING

- TB.2411/07/1/2: Genetic studies in order to broaden the genetic base of potato breeding. 1974. A.F. Visser
- TB.2411/07/2/1: Anther culture as technique in the upgrading of potatoes. 1983. M.H. Crespo

## PATHOLOGY/PATOLOGIE

- TB.2411/19/1/2: Study and control of common scab of potatoes. 1978. B.W. Young
- TB.2411/19/1/3: The chemical control of Fusarium dry rot in potatoes. 1980. B.W. Young
- TB.2411/19/1/4: Ecology and control of black scurf in potatoes. 1979. B.W. Young
- TB.2411/19/1/5: Control of silver scurf on potatoes. 1984. L. Marais
- TB.2411/19/1/6: Study of silver scurf on potatoes. 1985. L. Marais
- TB.2411/19/1/7: Control of anthracnose on potatoes. 1984. L. Marais
- TB.2411/19/1/8: Study of anthracnose on potatoes. 1985. L. Marais
- TB.2411/19/2/1: Bacterial wilt on potatoes caused by *Pseudomonas solanacearum*: isolation of causal bacterium. 1984. A.E. Swanepoel
- TB.2411/19/2/2: Bacterial wilt of potatoes caused by *Pseudomonas solanacearum*: development of symptoms. 1984. A.E. Swanepoel
- TB.2411/19/3/3: Study of the aphid-virus complex and seed potato production. 1978. D.C.A. Hoffman
- TB.2411/19/3/6: Influence of potato virus X on different potato cultivars. 1980. D.C.A. Hoffman
- TB.2411/19/3/7: Potato virus Y in potatoes, identification and characterisation of strains. 1983. G.J. Thompson
- TB.2411/19/3/8: Potato leaf roll virus: purification procedures and anti-serum preparation. 1983. P.J. Prins

## PESTS/PLAE

- TB.2411/20/1/2: Bio-ecological study of the potato snout beetle. 1984. J.M.I. Donaldson
- TB.2411/20/1/4: A bio-ecological study of the black maize beetle *Heteronychus arator* on potatoes. 1984. J.M.I. Donaldson

## CROP SCIENCE/GEWASKUNDE

- TB.2411/30/1/1: Potato cultivar evaluation in the Winter Rainfall Region. 1973. A. Agenbag
- TB.2411/30/1/3: Introduction and preliminary evaluation of foreign potato cultivars. 1973. A.F. Visser
- TB.2411/30/2/3: Sprout stimulants for breaking of tuber dormancy of potatoes. 1978. K.P. Prinsloo

## Registered projects/Geregistreerde projekte

- TB.2411/30/2/5: Influence of planting and fertilisation techniques on potato production at Glen. 1979. H.L.J. Potgieter
- TB.2411/30/2/7: The influence of tuber size and planting method on potato production at Sandvet. 1980. G.S. Cloete
- TB.2411/30/2/8: Methods to control volunteer potatoes. 1979. B.J. Pieterse
- TB.2411/30/2/9: The evaluation of defoliant for potatoes. 1979. G.J.J. Lubbe
- TB.2411/30/2/11: An investigation to the effective utilisation of seed potatoes. 1983. B.J. Pieterse

## Vegetables/Groente

### TOMATOES/TAMATIES

#### UPGRADING/VEREDELING

- TB.2421/07/1/1: Breeding and selection of market tomatoes. 1975. S.E. Bosch
- TB.2421/07/1/2: Breeding and selection of processing tomatoes. 1975. S.E. Bosch

#### PESTS/PLAE

- TB.2421/20/1/2: Bio-ecological studies of *Liriomyza trifolii* on tomatoes. 1985. M.C. Bolton

#### CROP SCIENCE/GEWASKUNDE

- TB.2421/30/1/1: Evaluation of new market tomato cultivars and breeding lines. 1975. H.A. Dafel
- TB.2421/30/1/2: Evaluation of processing tomato cultivars and breeding lines. 1975. H.A. Dafel

#### WATER REQUIREMENTS/WATERBEHOEFTE

- TB.2421/31/1/1: Measurement of tomato leaf water potential. 1985. H.A. Dafel

### ONIONS/UIE

#### UPGRADING/VEREDELING

- TB.2422/07/1/1: Breeding and selection of onions. 1976. J.J.B. van Zijl
- TB.2422/07/1/2: The development of F1-hybrid onions in South Africa. 1983. Elsa van der Klashorst

#### PATHOLOGY/PATOLOGIE

- TB.2422/19/1/1: Studies of *Pyrenochaeta terrestris*, the pink root pathogen of onions. 1983. J.F. Ferreira

#### CROP SCIENCE/GEWASKUNDE

- TB.2422/30/1/1: Evaluation of onion cultivars and breeding lines. 1977. A.G. Comrie
- TB.2422/30/2/1: Influence of seed size and certain production practices on yield and quality of onions. 1984. A.G. Comrie

### COLE CROPS/KOOLGEWASSE

#### PHYSIOLOGY/FISIOLOGIE

- TB.2423/03/1/1: The influence of seed treatments on the germination/physiology of cole crops: cabbage. 1984. B.H. Boelema

**PATHOLOGY/PATOLOGIE**

- TB.2423/19/1/1: A study on the phenology, epidemiology and control of black leg (*Phoma lingam*) on cole crops: cabbage in Natal. 1984. B.H. Boelema

**CROP SCIENCE/GEWASKUNDE**

- TB.2423/30/1/1: Cole crops: evaluation of cabbage cultivars and breeding lines. 1976. P.J. Henrico  
TB.2423/30/1/3: Cole crops: evaluation of broccoli cultivars and breeding lines. 1981. W.P. Stapelberg

**WATER REQUIREMENTS/WATERBEHOEFTE**

- TB.2423/31/1/1: Determination of the water requirements of cole crops: cabbage. 1982. P.F. Nortjé

**ROOT CROP VEGETABLES/WORTELAGTIGE GROENTE**

**UPGRADING/VEREDELING**

- TB.2424/07/1/1: Root crop vegetables: breeding and selection of sweet potatoes. 1976. C.P. du Plooy

**CROP SCIENCE/GEWASKUNDE**

- TB.2424/30/1/1: Root crop vegetables: evaluation of sweet potato cultivars and breeding lines. 1976. C.P. du Plooy  
TB.2424/30/2/1: Root crop vegetables: the influence of spacing on sweet potato production. 1983. C.P. du Plooy

**LEGUME VEGETABLES/PEULGROENTE**

**PHYSIOLOGY/FISIOLOGIE**

- TB.2425/03/1/1: An evaluation of the efficiency of herbicides on green beans. 1981. P.F. Nortjé  
TB.2425/03/1/2: Evaluation of herbicides for phytotoxicity on green bean cultivars. 1981. P.F. Nortjé

**PATHOLOGY/PATOLOGIE**

- TB.2425/19/1/2: Legume vegetables: a study of common blight of green beans. 1984. B.H. Boelema

**CROP SCIENCE/GEWASKUNDE**

- TB.2425/30/1/2: Legume vegetables: evaluation of green pea cultivars and breeding lines. 1976. Elsa van der Klashorst  
TB.2425/30/1/3: Legume vegetables: evaluation of dry pea cultivars and breeding lines. 1977. Elsa van der Klashorst  
TB.2425/30/2/1: Legume vegetables: plant density studies with green beans. 1977. A.F. Coertze

**VINE CROPS/RANKGEWASSE**

**PHYSIOLOGY/FISIOLOGIE**

- TB.2426/03/1/1: Weed control studies in pumpkin and squashes. 1982. P.F. Nortjé

**UPGRADING/VEREDELING**

- TB.2426/07/1/1: Vine crop vegetables: breeding and selection of pumpkins. 1976. S.E. Bosch



## Registered projects/Geregistreeerde projekte

- TB.2426/07/1/2: Vine crop vegetables: breeding and selection of muskmelon. 1976. Elsa van der Klashorst

### PATHOLOGY/PATOLOGIE

- TB.2426/19/1/1: Virus diseases of vine crop vegetables. 1981. Francisca W. van der Meer

### CROP SCIENCE/GEWASKUNDE

- TB.2426/30/1/1: Vine crop vegetables: evaluation of pumpkin cultivars and breeding lines. 1977. Elsa van der Klashorst

## SUNDRY VEGETABLES/DIVERSE GROENTE

### CROP SCIENCE/GEWASKUNDE

- TB.2427/30/1/2: Sundry vegetables: cultivation studies with lettuce. 1983. C.P. du Plooy

## Flowers and ornamental plants/Blomme en sierplante

### PROTEAS

### PHYSIOLOGY/FISIOLOGIE

- TB.2431/03/1/1: Prevention and control of physiological leaf browning of protea. 1984. J.A. Brink

### UPGRADING/VEREDELING

- TB.2431/07/1/2: Hybridisation studies with proteas: genus *Protea*. 1985. G.J. Brits  
TB.2431/07/1/3: Mass selection for the upgrading of certain protea variants: genus *Protea*. 1985. G.J. Brits  
TB.2431/07/1/4: Single plant selection for the development of new clonal cultivars of proteas. 1985. G.J. Brits  
TB.2431/07/1/5: Hybridisation studies with proteas: genus *Leucospermum*. 1985. G.J. Brits

### CROP SCIENCE/GEWASKUNDE

- TB.2431/30/1/1: Collecting, maintaining and evaluation of protea research material. 1978. G.J. Brits  
TB.2431/30/1/2: Evaluation of protea cultivars and selections. 1978. G.J. Brits  
TB.2431/30/2/2: Reproduction of proteas by means of slips. 1978. G.J. Brits  
TB.2431/30/3/1: Orchard cultivation practices of proteas. 1978. G.J. Brits

## BULB FLOWER CROPS/BOLBLOMGEWASSE

### PHYSIOLOGY/FISIOLOGIE

- TB.2432/03/1/1: Embryo culture studies on bulb flower crops: *Gladiolus*. 1983. J.G.S. Janse van Rensburg  
TB.2432/03/1/2: Embryo culture studies on bulb flower crops: *Ornithogalum*. 1984. Bela M. Vcelar  
TB.2432/03/1/3: Rapid multiplication of bulb flower crops: *Ornithogalum maculatum* by means of tissue culture techniques. 1983. P.A. Landby  
TB.2432/03/1/4: Rapid multiplication of bulb flower crops, *Lachenalias* by means of tissue culture. 1982. J.G. Janse van Rensburg

## Registered projects/Geregistreeerde projekte

- TB.2432/03/1/5: Rapid multiplication of bulb flower crops, *Gladiolus* by means of tissue culture. 1983. J.L.F. Dutrieux

### NUTRITION/VOEDING

- TB.2432/05/1/1: Nutrient requirement of indigenous bulb flowers. 1984. D.I. Ferreira

### UPGRADING/VEREDELING

- TB.2432/07/1/4: Sito-genetical studies of bulb flower crops: *Lachenalias*. 1984. F.C. Hancke

### PATHOLOGY/PATOLOGIE

- TB.2432/19/1/1: Identification of the virus diseases of certain bulb flower crops. 1975. J.T. Burger
- TB.2432/19/1/2: Virus elimination by means of chemotherapy and meristem culture in bulb flower crops: *Ornithogalum*. 1984. Bela M. Vcelar
- TB.2432/19/2/1: Bulb flower crops: study of *Uromyces transversalis* on *Gladiolus*. 1984. J.F. Ferreira
- TB.2432/19/2/2: Chemical control of *Uromyces transversalis* on bulb flower crops: *Gladiolus*. 1984. J.F. Ferreira
- TB.2432/19/2/3: Bulb flower crops: chemical control of *Uromyces transversalis* on *Gladiolus*. 1984. J.F. Ferreira

### CROP SCIENCE/GEWASKUNDE

- TB.2432/30/1/2: Bulb flower crops: manipulation of flower and growth periods of *Lachenalias*. 1984. E. Badenhorst

## CUT FLOWERS AND POT PLANTS/SNYBLOMME EN POTPLANTE

### CROP SCIENCE/GEWASKUNDE

- TB.2433/30/1/2: Cut flowers and pot plants: harvesting control of roses by means of pruning practices. 1983. D.I. Ferreira

## Pome and stone fruits/Kern- en steenvrugte

### APPLES/APPELS

### PHYSIOLOGY/FISIOLOGIE

- VV.2441/03/2/3: A test for the occurrence of specific replant diseases of apples. 1982. L. van Zyl
- VV.2441/03/4/2: Effect of different nitrogen sources on the utilisation of nitrogen fertilisers by apples. 1985. M. du Preez
- VV.2441/03/6/1: Calcium-dip treatments for bitterpit control. 1976. T.R. Visagie
- VV.2441/03/6/4: An anatomical study of apple russetting. 1981. P. van der Merwe
- VV.2441/03/6/6: Uptake and translocation of silicon by the apple tree. 1982. J. Steenkamp
- VV.2441/03/6/7: The influence of nitrogen and potassium nutrition on the synthesis of organic acids and the incidence of bitterpit in apples. 1983. J. Steenkamp
- VV.2441/03/6/8: A study of the muddy brown discoloration of Starkrimson apples. 1982. C.F. Hansmann

## NUTRITION/VOEDING

- VV.2441/05/1/4: Mapping of FFTRI Experiment Farm apple orchard soils. 1975. J. Wooldridge
- VV.2441/05/1/6: Investigation and revision of methods of chemical analysis of soil and plant samples from apple orchards. 1984. M. Conradie
- VV.2441/05/2/4: Demonstration fertilisation experiments in apple orchards. 1973. G. Schliemann
- VV.2441/05/2/6: Seasonal distribution of nitrogen and potassium fertilisation for apple trees. 1985. M. du Preez
- VV.2441/05/2/7: Effect of nitrogen potassium and phosphate fertilisation practices on the fruit quality of apples. 1985. M. du Preez

## UPGRADING/VEREDELING

- VV.2441/07/1/2: Breeding of apple cultivars resistant to scab. 1977. J.H. Acker
- VV.2441/07/1/3: Breeding of late red apple cultivars. 1977. J.H. Acker
- VV.2441/07/1/5: Breeding of apple cultivars with a compact growth habit. 1977. J.H. Acker
- VV.2441/07/1/6: Mutation breeding *in vitro* of Granny Smith apple to develop a compact growth habit. 1985. R.E. Pieterse
- VV.2441/07/1/7: Development of Granny Smith apple plants from callus and single cells for use in mutation breeding. 1985. R.E. Pieterse

## PATHOLOGY/PATOLOGIE

- VV.2441/19/1/2: Investigation of curative and protective characteristics of existing and new fungicides for apple scab control. 1981. W.F.S. Schwabe
- VV.2441/19/1/3: Studies concerning requirements for apple fruit infection by *Venturia inaequalis*. 1981. W.F.S. Schwabe
- VV.2441/19/1/4: Implementation of an apple scab warning service. 1981. W.F.S. Schwabe
- VV.2441/19/1/6: Isolation techniques for collar and root rot pathogens of apples. 1982. M. Nicholson

## PESTS/PLAE

- VV.2441/20/1/1: Radiation sterilisation of the infesting stages of fruit flies. 1972. B.N. Barnes
- VV.2441/20/2/1: Bionomics of snout beetles on apples. 1981. B.N. Barnes
- VV.2441/20/2/2: Monitoring systems for pest mites and a mite predatory beetle on apples. 1981. K.L. Pringle
- VV.2441/20/2/3: Bionomics of codling moth on apples. 1982. T.L. Blomefield
- VV.2441/20/2/4: Selective pesticides for the mite predatory beetle on apples. 1985. M.A. Venter
- VV.2441/20/3/1: Survey of the different nematode species occurring in Western Cape apple orchards. 1979. H.J. Hugo
- VV.2441/20/3/2: Chemical control of nematodes attacking apple trees. 1980. H.J. Hugo

## CROP SCIENCE/GEWASKUNDE

- VV.2441/30/1/1: The planting and maintenance of apple cultivars. 1972. J.V. Hadlow
- VV.2441/30/1/2: Second phase evaluation of apple cultivars in the Western Cape. 1971. P.R. Jolly
- VV.2441/30/1/3: Evaluation of Starking-type apples. 1978. P.R. Jolly
- VV.2441/30/1/4: Evaluation of Golden Delicious apple types. 1979. P.R. Jolly
- VV.2441/30/3/2: The pruning of close-planted apples. 1972. O. Bergh



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- VV.2441/30/3/3: Training systems for apples on dwarfing rootstocks. 1972. O. Bergh  
VV.2441/30/4/1: Fruit size in apples. 1971. O. Bergh  
VV.2441/30/6/1: Evaluation of grasses and legumes as cover crops in apple orchards of the Western Cape. 1983. R.E. Harris

## WATER REQUIREMENTS/WATERBEHOEFTE

- VV.2441/31/1/2: Effect of irrigation scheduling and soil moisture regime on the yield and quality of apples. 1985. W.A.G. Kotzé  
VV.2441/31/1/3: Effect of irrigation system, irrigation schedule and soil management on root development by apple tree and utilisation of applied water. 1985. J.H.M. Karsten

## METEOROLOGY/WEERKUNDE

- VV.2441/33/1/1: Overhead cooling of apples. 1979. W.A.G. Kotzé

## TECHNOLOGY/TEGNOLOGIE

- VV.2441/52/1/1: Influence of gas composition during controlled atmosphere storage on the keeping quality of apples. 1978. A.B. Truter  
VV.2441/52/1/3: Effect and rate of re-cooling and atmosphere modification on apple quality. 1984. A.J.M. van der Westhuizen

## CHEMISTRY/CHEMIE

- VV.2441/53/1/1: Development of an objective index for quality of apple juice based on the flavour components of apples. 1982. C.A.R. Hurt  
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## PEARS/PERE

## PHYSIOLOGY/FISIOLOGIE

- VV.2442/03/2/1: The effect of viruses on the performance of pear cultivars. 1972. H.J. van Zyl  
VV.2442/03/2/2: Growth control of pears with growth retardants. 1982. H.J. van Zyl  
VV.2442/03/5/1: Effect of calcium, hormones and seed content on premature ripening of pears. 1982. H.J. van Zyl  
VV.2442/03/5/2: The effect of post-harvest calcium-dip treatments on the keeping quality and ripening of pears. 1983. G.J. Eksteen  
VV.2442/03/5/3: Effect of fluctuation in orchard temperature on premature ripening of pears. 1983. H.J. van Zyl

## NUTRITION/VOEDING

- VV.2442/05/1/1: Pears: determination of the effect of soil pH and of potassium and nitrogen fertilisation on the growth, yield and fruit quality of pears. 1982. J. Wooldridge

## UPGRADING/VEREDELING

- VV.2442/07/1/1: Breeding of precocious late pear cultivars. 1977. J.H. Acker  
VV.2442/07/1/2: Breeding of pear cultivars resistant to scab. 1977. W.J.C. Smith  
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PESTS/PLAE

- VV.2442/20/1/1: Chemical control of codling moth on pears. 1977. T.L. Blomefield

CROP SCIENCE/GEWASKUNDE

- VV.2442/30/1/1: The planting and maintenance of pear cultivars. 1970. C. van Zyl  
VV.2442/30/1/2: Second phase evaluation of pear cultivars in the winter rainfall area. 1971. P.R. Jolly  
VV.2442/30/2/1: Evaluation of pear rootstocks in the winter rainfall area. 1971. J.D. Stadler  
VV.2442/30/3/1: Increasing of production of pears. 1978. P. van Huyssteen  
VV.2442/30/3/2: Comparison of training systems for pears in the Groot-Drakenstein area. 1983. P. van Huyssteen  
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TECHNOLOGY/TEGNOLOGIE

- VV.2442/52/1/1: Controlled-atmosphere storage of pears. 1982. A.B. Truter  
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PEACHES/PERSKES

PHYSIOLOGY/FISIOLOGIE

- VV.2443/03/2/1: Growth control of peaches with retardants. 1982. H.J. van Zyl  
VV.2443/03/4/4: Factors which cause pit burn and internal breakdown in peaches. 1984. B.K. Nortjé

NUTRITION/VOEDING

- VV.2443/05/1/2: Scheduling of nitrogen application through the irrigation system for peaches (nectarines). 1982. M. du Preez  
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UPGRADING/VEREDELING

- VV.2443/07/1/1: Breeding of canning peaches. 1971. P.F. Louw  
VV.2443/07/1/2: Breeding of yellow flesh peach cultivars suitable for drying and dessert. 1979. P.F. Louw

PESTS/PLAE

- VV.2443/20/2/1: Bionomics of false codling moth on peaches. 1982. M.A. Huiskens

CROP SCIENCE/GEWASKUNDE

- VV.2443/30/1/1: The planting and maintenance of peach cultivars. 1970. J.W. Etsebeth  
VV.2443/30/1/2: Second phase evaluation of peach cultivars in the Western Cape. 1971. C.W.J. Bester  
VV.2443/30/1/5: Evaluation of peach breeding lines in Natal. 1981. P.C. van Rooyen  
VV.2443 30/2/2: Peaches: evaluation of peach rootstocks at Robertson Experiment Farm. 1982

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- VV.2443/30/3/3: Comparison of plant and training systems for peaches. 1984. J.D. Stadler
- VV.2443/30/3/4: Comparison of plant and training systems for peaches in the summer rainfall area. 1985. R.A.W. Gardener
- VV.2443/30/4/1: Efficiency and phytotoxicity of herbicides when used together with peaches. 1984. A.F. Lourens

## WATER REQUIREMENTS/WATERBEHOEFTE

- VV.2443/31/1/1: Lysimeter studies on irrigation scheduling with peaches. 1979. H. Tormann
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## PLUMS/PRUIME

### PHYSIOLOGY/FISIOLOGIE

- VV.2444/03/1/1: Development of a technique to regenerate plum plants from protoplasts. 1982. C. Thomas
- VV.2444/03/3/1: Chemical manipulation of fruit set and thinning of plums (prunes). 1984. A.F. Lourens
- VV.2444/03/4/1: Relationship between orchard temperature, fruit size, nutrient uptake and internal breakdown of plums. 1983. H. Tormann
- VV.2444/03/4/2: Chemical composition of plums with regard to the incidence of internal breakdown. 1984. K.H. Gürgen
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### NUTRITION/VOEDING

- VV.2444/05/1/1: Determination of the lime requirement of plums. 1982. W.A.G. Kotzé

### UPGRADING/VEREDELING

- VV.2444/07/1/1: Breeding of plum cultivars resistant to bacterial spot. 1972. J.H. Acker

### PATHOLOGY/PATOLOGIE

- VV.2444/19/1/1: Infection and release of *Xanthomonas campestris* pv. *pruni* in plum trees. 1979. H.J. du Plessis
- VV.2444/19/1/2: Epidemiology of bacterial canker on plums in South Africa. 1981. I.M.M. Roos
- VV.2444/19/1/5: Identification of the *Monilinia* spp. involved in the blossom blight/brown rot disease complex on plums. 1982. H.E. van Rensburg
- VV.2444/19/1/6: Geographical distribution of moulds causing post-harvest decay of plums. 1982. J.F. Fourie
- VV.2444/19/1/8: Etiology of bacterial canker of plums. 1985. I.M.M. Roos
- VV.2444/19/1/9: Effect of soil reaction to nitrogen nutrition on pre-disposition of plum trees for bacterial diseases. 1985. C. Human

### CROP SCIENCE/GEWASKUNDE

- VV.2444/30/1/1: The planting and maintenance of plum cultivars. 1970. C. van Zyl
- VV.2444/30/1/2: Second phase evaluation of plum cultivars in the Western Cape. 1971. C.W.J. Bester
- VV.2444/30/2/2: Phase-two evaluation of locally bred plum rootstocks. 1980. J.H. Acker



VV.2444/30/4/1: Effect of thinning on fruit size and yield of plums. 1982. J.D. Stadler

#### APRICOTS/APPELKOSE

##### NUTRITION/VOEDING

VV.2445/05/1/1: Effect of pre- and post-planting organic fertilisation on the performance of apricot trees on two training systems. 1982. M. du Preez

##### UPGRADING/VEREDELING

VV.2445/07/1/1: Breeding of early canning apricots. 1977. M.J. van Tonder

VV.2445/07/1/2: Breeding of apricots suitable for drying. 1977. M.J. van Tonder

VV.2445/07/1/3: Mutation breeding of apricots. 1977. J.P. Human

VV.2445/07/1/6: Mutation breeding *in vitro* of Royal apricot to develop better resistance against *Pseudomonas* and/or *Xanthomonas*. 1985. R.E. Pieterse

##### CROP SCIENCE/GEWASKUNDE

VV.2445/30/1/1: Planting maintenance of apricot cultivars. 1972. W.C. Nel

VV.2445/30/1/2: Second phase evaluation of apricot cultivars in the Western Cape. 1971. C.W.J. Bester

VV.2445/30/2/1: Evaluation of apricot rootstocks at Robertson Experiment Farm. 1971. J.D. Stadler

VV.2445/30/3/1: Comparison of training and pruning systems for apricots. 1982. J.D. Stadler

#### CHERRIES/KERSIES

##### CROP SCIENCE/GEWASKUNDE

VV.2446/30/1/1: Second and third phase evaluation of cherry cultivars in the Western Cape. 1977. P.R. Jolly

##### METEOROLOGY/WEERKUNDE

VV.2446/33/1/1: Influence of micro-climate on intensity of bacterial canker on cherries. 1985. C. Human

#### Berry fruits/Bessievrugte

##### BERRIES/BESSIES

##### NUTRITION/VOEDING

VV.2451/05/1/1: Berries: effect of differential N and K fertilisation on production of two strawberry cultivars. 1983. C. Human

##### UPGRADING/VEREDELING

VV.2451/07/1/1: Berries: utilisation of the genetic variation in strawberries on the octoploid level. 1972. J.H. Acker

VV.2451/07/1/4: Breeding of new bramble cultivars. 1971. J.H. Acker

##### CROP SCIENCE/GEWASKUNDE

VV.2451/30/1/1: Second and third phase evaluation of strawberries in the Western Province. 1973. C.W.J. Bester

## Registered projects/Geregistreeerde projekte

- VV.2451/30/1/2: Berries: evaluation of local strawberry selections and imported cultivars in the summer rainfall areas. 1985. L.L. van der Merwe

### TECHNOLOGY/TEGNOLOGIE

- VV.2451/52/1/1: Berries: post-harvest handling of strawberries. 1984. A.B. Truter

## Viticulture/Wingerdbou

### TABLE GRAPES/TAFELDRUIWE

#### PHYSIOLOGY/FISIOLOGIE

- VV.2461/03/5/1: Effect of soil moisture tension, time of harvest and delay in cooling on the incidence of drop berries in Waltham Cross grapes. 1980. J.C. Combrink
- VV.2461/03/5/2: Effect of pre- and post-harvest treatments on the incidence of split berry in Alphonse Lavallée table grapes. 1980. J.C. Combrink
- WW.2461/03/1/2: The effect of two plant growth regulators on the characteristics of Waltham Cross and Sultanina table grapes. 1985. G.N. Wagener

#### NUTRITION/VOEDING

- VV.2461/05/1/1: Fertilisation on table grapes through drip and microjet irrigation systems. 1972. I.S. de Kock

#### UPGRADING/VEREDELING

- VV.2461/07/1/1: Breeding of a late white table grape. 1977. P.J.L. Ellis
- VV.2461/07/1/2: Breeding of early black and white table grape cultivars. 1977. P.J.L. Ellis
- VV.2461/07/1/3: Breeding of new seedless table grape cultivars. 1977. P.J.L. Ellis

#### PATHOLOGY/PATOLOGIE

- VV.2461/19/1/1: Sources of survival of the table grape pathogen *Botrytis cinerea* and factors which influence dissemination. 1978. A.C. Thomas
- VV.2461/19/1/2: Chemical control of *Botrytis cinerea* in table grapes. 1972. C.A. de Klerk
- WW.2461/19/1/3: Effect of climate and phenological stage of the vine on infection of table grapes by *Botrytis cinerea*. 1984. C.A. de Klerk

#### PESTS/PLAE

- VV.2461/20/1/2: Control of sparrows in table grapes with bait in cages. 1980. J.D. Stadler

#### CROP SCIENCE/GEWASKUNDE

- VV.2461/30/1/2: Evaluation of table grape cultivars and selections in the Olifants River Valley. 1971. D.C. Uys
- VV.2461/30/1/3: Evaluation of table grape cultivars and selections in the Paarl area. 1971. D.C. Uys
- VV.2461/30/2/1: Evaluation of table grape rootstocks in the Hex Valley. 1972. E.W. Mostert
- VV.2461/30/2/2: Evaluation of table grape rootstocks in the Paarl area. 1972. G.J. le G. Smit
- WW.2461/30/1/3: The relative performance of rootstock cultivars for table grapes in the summer rainfall areas. 1985. J.H. Avenant

WATER REQUIREMENTS/WATERBEHOEFTE

- VV.2461/31/1/1: The effect of different soil moisture regimes on the yield and growth of Berlinka table grapes. 1980. I.S. de Kock

TECHNOLOGY/TEGNOLOGIE

- WW.2461/52/1/1: Optimum harvesting stages for table grape cultivars. 1985. Julia C. László

WINE GRAPES/WYNDRUIWE

ANATOMY/ANATOMIE

- WW.2462/02/1/1: Wine grapes: anatomy and ultrastructure of one-year-old shoots of *Vitis*. 1981. E. Archer
- WW.2462/02/1/2: Anatomy and ultrastructure of the leaf of wine grapes and other grapes. 1983. C.E. de Villiers

NUTRITION/VOEDING

- WW.2462/05/1/1: Effect of rootstock on the mineral status of scions. 1981. J.M. Southey
- WW.2462/05/1/2: The NPK requirements of wine grapes: Stellenbosch. 1963. W.J. Conradie
- WW.2462/05/1/3: The effect of application time, quantity and form of N fertilisation on wine grapes: Stellenbosch. 1979. W.J. Conradie

UPGRADING/VEREDELING

- WW.2462/07/1/1: Sifting evaluation of new scion cultivars and hybrids for wine grapes: Stellenbosch. 1965. F.S. de Villiers
- WW.2462/07/1/2: Sifting evaluation of new scion cultivars and hybrids for wine grapes: Lutzville. 1972. F.S. de Villiers
- WW.2462/07/1/3: Evaluation of compatability and affinity of rootstocks for scion cultivars of wine grapes. 1975. D. van Schalkwyk
- WW.2462/07/2/1: Evaluation of clones of wine grapes: Muscat d'Alexandrie. 1974. G.J.J. Albertse

PATHOLOGY/PATOLOGIE

- WW.2462/19/1/1: Combined chemical control of economic important diseases attacking aerial parts of the grapevine: coastal area. 1976. S.H.Z. Cilliers
- WW.2462/19/1/2: Combined chemical control of economic important diseases attacking aerial parts of the grapevine: Lower Orange River area. 1976. J.A. Sutherland
- WW.2462/19/1/3: Chemical control of dying arm of wine grapes: laboratory studies. 1978. J.H.S. Ferreira
- WW.2462/19/1/5: Development of rapid screening techniques for resistance against oidium of wine grape cultivars. 1976. C.J. Schuman
- WW.2462/19/1/6: Effect of viticultural practices on the incidence of *Botrytis* rot. 1981. J.H.S. Ferreira
- WW.2462/19/1/7: Identification of the organisms of dying arm of wine grapes and the study of their interactions. 1978. J.H.S. Ferreira
- WW.2462/19/2/1: Evaluating resistance against *Phytophthora cinnamomi* of wine grape rootstocks. 1974. P.G. Marais
- WW.2462/19/2/2: Chemical and biological control of *Phytophthora cinnamomi* on grapevine rootstocks in wine grapes. 1976. P.G. Marais



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- WW.2462/19/2/3: Control of crown gall in wine grapes. 1981. J.H.S. Ferreira
- WW.2462/19/2/4: Relative resistance of rootstock cultivars against crown gall. 1981. J.H.S. Ferreira

### PESTS/PLAE

- WW.2462/20/1/1: Chemical control of nematodes in wine grapes. 1980. J.T. Loubser
- WW.2462/20/1/2: Development of techniques for evaluating phylloxera resistance of wine grape rootstocks. 1979. C.A. de Klerk
- WW.2462/20/1/3: Development of techniques for evaluating nematode resistance of wine grape rootstocks. 1980. J.T. Loubser
- WW.2462/20/1/4: Chemical control of margarodes in wine grapes. 1982. C.A. de Klerk
- WW.2462/20/1/5: Biology of root knot nematodes attacking wine grapes. 1982. J.T. Loubser
- WW.2462/20/2/2: Chemical control of snails on wine grapes. 1979. A. Schwartz
- WW.2462/20/2/3: Development of techniques for evaluating bird damage on wine grapes. 1980. G.B. Dennill
- WW.2462/20/2/5: Biology of the leafhoppers which occur on wine grapes. 1982. E. Marais
- WW.2462/20/2/7: Determination of the correct application of pesticides for the control of snoutbeetles on wine grapes. 1985. M.W. Siebert

### CROP SCIENCE/GEWASKUNDE

- WW.2462/30/1/1: Integration of budding percentage, fertility and shoot vigour into a standard for pruning recommendations for wine grapes. 1979. J.J. Swanepoel
- WW.2462/30/1/2: Effect of method and time of pruning on phenology and production of wine grapes: Chenin blanc. 1979. J.J. Swanepoel
- WW.2462/30/2/1: Optimal crop load of wine grapes under irrigation as well as under dryland conditions in Stellenbosch. 1977. J.M. Southey
- WW.2462/30/2/3: Optimal crop load for wine grapes on different rootstocks at Robertson: Muscadel. 1978. G.W. Fouche
- WW.2462/30/3/1: The effect of soil preparation methods and depths as well as different ameliorants on the soil and the performance of wine grapes: Stellenbosch. 1977. L. van Huyssteen
- WW.2462/30/3/3: Soil ridging to improve soil physical condition and vine response. 1984. P.A. Myburgh
- WW.2462/30/4/3: Wine grapes: herbigation in vineyards through a microjet irrigation system. 1985. J.C. Fourie
- WW.2462/30/5/1: Effect of soil/climate association in climate region II on the relative performance of wine grapes: Hermanus. 1979. J.D. Rossouw
- WW.2462/30/5/2: Relative performance of cultivars for wine grapes in climate region II: Darling. 1975. J.D. Rossouw
- WW.2462/30/5/4: The effect of soil/climate association in climate region IV on the relative performance of wine grapes: Nuy/Overhex/Doringrivier. 1973. B.C.H. Rix
- WW.2462/30/5/5: Relative performance of cultivars for wine grapes in climate region IV: Rawsonville/Slanghoek. 1974. J.D. Rossouw
- WW.2462/30/5/6: Relative performance of cultivars for wine grapes in climate region IV: Bonnievale. 1974. J.D. Rossouw
- WW.2462/30/5/7: Relative performance of cultivars for wine grapes in climate region V: Vaalharts. 1973. W.F. van der Westhuizen
- WW.2462/30/5/8: Relative performance of cultivars for wine grapes in climate region V: Barkly West. 1976. W.F. van der Westhuizen

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- WW.2462/30/5/9: Relative performance of cultivars for wine grapes in climate region V: Vredendal/Klawer. 1974. G.J.J. Albertse
- WW.2462/30/5/10: Relative performance of cultivars for wine grapes in climate region V: Eastern Cape (Cradock). 1977. F.S. de Villiers
- WW.2462/30/5/11: Relative performance of cultivars for wine grapes: co-operation with the O.I.V. 1975. F.S. de Villiers
- WW.2462/30/6/1: Relative performance of wine grape rootstocks on Dundee soil: Montagu. 1974. J.M. Southey
- WW.2462/30/6/5: Relative performance of rootstock cultivars for wine grapes (Muscat d'Alexandrie) on an Oakleaf/Westleigh soil: Rawsonville. 1982. A.C. de la Harpe
- WW.2462/30/6/6: Relative performance of rootstock cultivars for wine grapes on a sandy soil: Franschoek. 1982. J.C.D. Theron
- WW.2462/30/6/7: The physiological response and performance of rootstocks for wine grapes to saline environments. 1985. J.M. Southey
- WW.2462/30/8/1: The effect of nursery practices on the survival percentage of grafted vines for wine grapes. 1985. D. van Schalkwyk

## WATER REQUIREMENTS/WATERBEHOEFTE

- WW.2462/31/1/1: The effect of irrigation methods and soil moisture regimes during different phenological stages on the performance of wine grapes: Robertson. 1975. J.L. van Zyl
- WW.2462/31/1/2: Irrigation and cultivation studies on wine grapes planted on alluvial soil: Oudtshoorn. 1978. J.L. van Zyl
- WW.2462/31/1/3: Wine grapes: effects of irrigation during ripening on the quality of a red grape cultivar. 1985. J.L. van Zyl

## DRYING GRAPES/DROOGDRUIWE

### PHYSIOLOGY/FISIOLOGIE

- WW.2463/03/1/2: Shifting the optimal ripening stage of raisin grape cultivars with ethephon: Sultana. 1981. J.J. Burnett
- WW.2463/03/1/3: The control of excessive vegetative growth of raisin grapes by means of ethephon: Sultana. 1981. J.J. Burnett

### UPGRADING/VEREDELING

- WW.2463/07/1/1: Selection and evaluation of promising commercial drying grape genotypes from the industry and the conservation of the best clonal material. 1973. G.J.J. Albertse

### CROP SCIENCE/GEWASKUNDE

- WW.2463/30/1/1: Semi-commercial evaluation of raisin grape cultivars and clones in different environments. 1982. G.J.J. Albertse
- WW.2463/30/1/2: Relative performance of new cultivars of raisin grapes in the Lower Orange River area. 1983. C.J. Smit
- WW.2463/30/1/3: Sifting evaluation of new raisin grape cultivars: Robertson. 1982. G.J.J. Albertse
- WW.2463/30/1/6: Relative performance of drying grape (raisin) cultivars in the Olifants River area. 1985. G.J.J. Albertse

## Oenology/Wynkunde

### WINE/WYN

#### TAXONOMY/TAKSONOMIE

- WW.2471/01/1/1: The recognition of wine yeast strains using endogenous protein patterns and fermentation metabolites. 1985. H.G. Tredoux

#### MICROBIOLOGY/MIKROBIOLOGIE

- WW.2471/08/1/1: Evaluation of commercially dried yeast and the dehydratability of promising yeast strains. 1975. M. Strydom
- WW.2471/08/1/2: Determination of the oenological properties of wine yeasts. 1982. M. Strydom
- WW.2471/08/1/3: The effect of storage carbohydrates and phospholipid concentrations in wine yeast on fermentation. 1985. E.E.J. Simpson
- WW.2471/08/2/1: Effect of nitrogen composition of must on fermentation and wine quality. 1981. T.J. van Rooyen
- WW.2471/08/2/2: Effect of spray residues on fermentation and wine quality. 1981. T.J. van Rooyen
- WW.2471/08/2/3: Effect of must and wine composition on the completion of fermentation. 1980. A. Tromp
- WW.2471/08/2/5: The effect of chemical compounds found in must on the transport mechanisms and temperature sensitivity of wine yeasts. 1985. R.P. Tracey
- WW.2471/08/2/6: The determination of lipids in grapes and must. 1984. A. Tromp

#### TECHNOLOGY/TEGNOLOGIE

- WW.2471/52/1/1: Factors that determine the reproducibility of aroma formation in and the quality of wine. 1977. A.C. Houtman
- WW.2471/52/1/2: Determination of the optimum fermentation temperatures of wines. 1981. C. Kock
- WW.2471/52/1/3: Wood ageing of wine: white wine. 1981. G.W.W. Wagener
- WW.2471/52/1/4: Evaluation of wine-making equipment. 1981. G.W.W. Wagener
- WW.2471/52/1/5: Grape and must handling for optimum wine quality with high quality grapes. 1980. G.W.W. Wagener
- WW.2471/52/2/1: Lowering of SO<sub>2</sub> requirement of wines, or alternatively the elimination of the use of SO<sub>2</sub> in wine and during vinification. 1975. M. Strydom
- WW.2471/52/2/2: Routine analyses for microbial stability of wine. 1981. T.J. van Rooyen

#### CHEMISTRY/CHEMIE

- WW.2471/53/1/3: Screening of volatile components in wine in relation to wine quality: Pinotage. 1981. P.C. van Rooyen
- WW.2471/53/1/4: Screening of volatile components in wine in relation to wine quality: Cabernet Sauvignon. 1981. P.C. van Rooyen
- WW.2471/53/1/5: Volatile components responsible for the cultivar character in Cabernet Sauvignon. 1981. O.P.H. Augustyn
- WW.2471/53/1/6: The effect of some phenolic compounds of the bitterness and coarseness of white table wines. 1984. L.P. Ellis
- WW.2471/53/2/1: Short-term international O.I.V. studies into the chemical aspects of wine and other products of the vine. 1977. E.J.J. Simpson



## Registered projects/Geregistreerde projekte

- WW.2471/53/2/2: Development of a method for analysis of aroma components in the vapour phase of wine. 1981. O.P.H. Augustyn
- WW.2471/53/2/4: Development of a gas chromatographic technique for the quantitative determination of terpenoid compounds in grapes and wine. 1982. J. Marais
- WW.2471/53/2/6: Development of technique for the quantitative determination of phenolic compounds in grapes and wine. 1982. L.P. Ellis
- WW.2471/53/2/7: Development of a method for the quantitative determination of steroids and related compounds in grapes, must and wine. 1982. J. Venter
- WW.2471/53/4/1: The study of factors that will affect the short-term shelf life of wines. 1982. C.S. du Plessis
- WW.2471/53/4/2: Relationship between terpene compounds in grapes and wine and the quality of wines. 1983. J. Marais

## BRANDY/BRANDEWYN

### CHEMISTRY/CHEMIE

- WW.2472/53/1/1: The effect of specific wine components on quality of brandy. 1979. G.W.W. Wagener

## Citrus and subtropical crops/Sitrus- en subtropiese gewasse

### CITRUS/SITRUS

#### PHYSIOLOGY/FISIOLOGIE

- SS.2481/03/1/1: Development of tissue culture techniques for the production of embryonic callus and protoplasts in citrus. 1985. J.H. de Lange
- SS.2481/03/1/2: Development of techniques for pollen cultures of citrus. 1985. J.H. de Lange
- SS.2481/03/1/3: Regeneration of embryos from chimeras of citrus. 1985. J.H. de Lange

#### NUTRITION/VOEDING

- SS.2481/05/1/1: Effect of different liming agents on soil acidity in citrus and avocado orchards. 1980. G. Smart
- SS.2481/05/1/2: Macro- and micro-element fertilisation of citrus in the Citrusdal area. 1971. S.F. du Plessis
- SS.2481/05/1/3: Citrus determination of the nutritional requirements of lemons. 1983. S.F. du Plessis
- SS.2481/05/1/4: Potassium experiments with citrus on problem soils. 1977. T.J. Koen

#### UPGRADING/VEREDELING

- SS.2481/07/1/1: Breeding and selection to obtain improved rootstocks for citrus. 1983. J.H. de Lange
- SS.2481/07/1/2: Breeding and selection to obtain improved citrus cultivars. 1983. J.H. de Lange
- SS.2481/07/1/3: Production of improved citrus types by means of shoot tip grafting and tissue culture. 1983. J.H. de Lange
- SS.2481/07/1/4: Development of black spot tolerant citrus. 1985. J.H. de Lange
- SS.2481/07/1/5: Development of citrus tolerant to greening disease. 1985. J.H. de Lange
- SS.2481/07/1/6: Development of citrus tolerant to tristeza. 1985. J.H. de Lange
- SS.2481/07/1/7: Development of seedless citrus cultivars by means of irradiation. 1985. J.H. de Lange

## Registered projects/Geregistreeerde projekte

- SS.2481/07/1/8: Development of improved easy peeling citrus cultivars. 1985. J.H. de Lange  
SS.2481/07/1/9: Development of citrus rootstocks tolerant to salinity. 1985. J.H. de Lange

## VIROLOGY/VIROLOGIE

- SS.2481/12/1/1: Basic studies on tristeza virus of citrus. 1976. J.N. Moll

## PATHOLOGY/PATOLOGIE

- SS.2481/19/1/1: Control of the greening organism in citrus. 1971. S.P. van Vuuren  
SS.2481/19/1/3: Isolation of the greening organism of citrus. 1971. B.Q. Manicom  
SS.2481/19/1/4: Isolation and control of the greening organism of citrus. 1981. J.N. Moll  
SS.2481/19/2/1: Tristeza mild strain protection of lime and grapefruit citrus cultivars. 1976. S.P. van Vuuren  
SS.2481/19/2/3: Indexing for virus diseases of citrus. 1971. S.P. van Vuuren  
SS.2481/19/2/4: Resistance of bitter seville citrus rootstocks to tristeza. 1969. S.P. van Vuuren  
SS.2481/19/3/1: Studies on citrus black spot (*Guignar dia citricarpa*). 1983. J.A. Herbert

## PESTS/PLAE

- SS.2481/20/1/2: Chemical control of citrus thrips in biological-controlled orchards. 1969. E.C.G. Bedford  
SS.2481/20/1/3: The role of ants in pest control in citrus. 1980. M.J. Samways  
SS.2481/20/1/5: Control of false codling moth in citrus. 1971. P.J. Newton  
SS.2481/20/1/6: Studies on citrus psylla. 1981. M.A. van den Berg  
SS.2481/20/1/7: Integrated pest control of citrus in the Cape Province. 1985. W.J. du Toit  
SS.2481/20/1/8: Ecology, chemical and biological control of citrus mites. 1985. P.F. Fourie  
SS.2481/20/3/1: Entomogenic fungi for the control of citrus pests. 1982. N.M.G. Grech

## CHEMICAL CONTROL/CHEMIESE BEHEER

- SS.2481/21/1/1: Chemical control of weeds in citrus orchards. 1983. A.P. Vincent

## CROP SCIENCE/GEWASKUNDE

- SS.2481/30/1/1: Rough lemon selections as rootstocks. 1968. J. Bredell  
SS.2481/30/1/2: Rootstocks for citrus: navels and Valencias. 1969. J. Bredell  
SS.2481/30/1/3: Citrus and related genera as rootstocks for citrus. 1969. J.H. de Lange  
SS.2481/30/1/4: Trifoliata hybrids as rootstocks for citrus: navels. 1980. J. Bredell  
SS.2481/30/2/1: Production of virus-free nucellar citrus material at Messina. 1968. G.S. Bredell  
SS.2481/30/2/2: Citrus cultivars and selections - Valencias. 1968. J. Bredell  
SS.2481/30/2/3: Citrus cultivars and selections - navels. 1974. W.P. Burger  
SS.2481/30/2/4: Citrus cultivars and selections - grapefruit. 1972. J. Bredell  
SS.2481/30/2/5: Citrus cultivars and selections - rose grapefruit. 1978. W.P. Burger  
SS.2481/30/2/7: Citrus cultivars and selections - mid-seasons. 1976. W.P. Burger  
SS.2481/30/2/8: Citrus cultivars and selections - early and late maturing navels. 1977. W.P. Burger  
SS.2481/30/2/9: Citrus cultivars and selections - easy peelers. 1972. J.H. de Lange

## Registered projects/Geregistreerde projekte

- SS.2481/30/2/10: Fruit set studies of citrus. 1972. J.H. de Lange  
SS.2481/30/2/11: Conservation and evaluation of genetic material. 1984. W.P. Burger  
SS.2481/30/4/1: Nursery techniques involved in propagation of citrus trees. 1972. P.J. Müller  
SS.2481/30/6/1: Yield forecast for citrus in different production areas. 1981. N.B. Human  
SS.2481/30/7/1: High density planting of citrus - navels, Valencias and grapefruit. 1985. H.J. Breedt  
SS.2481/30/7/2: Dwarfing of citrus trees. 1985. H.J. Breedt

## WATER REQUIREMENTS/WATERBEHOEFTE

- SS.2481/31/1/1: Water requirements of citrus at Nelspruit. 1968. P.J. Müller  
SS.2481/31/1/2: Water requirements of citrus at Addo. 1976. J. Bredell

## SOIL SCIENCE/GRONDKUNDE

- SS.2481/32/1/1: Determination of the role of soil physical characteristics on the growth and development of citrus trees. 1980. D.J. Nel

## CHEMISTRY/CHEMIE

- SS.2481/53/1/1: Enzymatical reactions involved with greening disease in citrus under orchard conditions. 1985. L.J. van Lelyveld  
SS.2481/53/1/2: Enzymatical reactions for greening disease in citrus tissue culture. 1985. L.J. van Lelyveld

## PINEAPPLES/PYNAPPELS

### PHYSIOLOGY/FISIOLOGIE

- SS.2482/03/1/1: Development of tissue culture techniques for the production of embryonic callus and protoplasts in pineapples. 1984. M. Fitchet  
SS.2482/03/1/2: Clonal propagation of pineapples *in vitro*. 1984. M. Fitchet

### NUTRITION/VOEDING

- SS.2482/05/1/1: Nutritional requirements of pineapples in the Eastern Cape Region. 1972. W. Langenegger  
SS.2482/05/1/2: Macro-element fertilisation of pineapples in Zululand. 1972. S.F. du Plessis

### UPGRADING/VEREDELING

- SS.2482/07/1/1: Selection and vegetative propagation of improved pineapple clones. 1967. E.R. Dalldorf

## CHEMICAL CONTROL/CHEMIESE BEHEER

- SS.2482/21/1/1: Control of soil insects in pineapples. 1974. G.J. Petty  
SS.2482/21/1/2: Control of leaf and fruit insects on pineapples. 1974. G.J. Petty  
SS.2482/21/1/3: Control of nematodes in pineapples. 1971. P.F. du Toit

## CROP SCIENCE/GEWASKUNDE

- SS.2482/30/1/1: Phenology of pineapples. 1974. D.B. Dalldorf  
SS.2482/30/1/2: Crop manipulation in pineapples. 1970. D.B. Dalldorf



## Registered projects/Geregistreeerde projekte

- SS.2482/30/1/3: Evaluation of herbicides for pineapples. 1971. E.R. Dalldorf  
SS.2482/30/1/4: Evaluation of mulching for pineapples. 1978. E.R. Dalldorf  
SS.2482/30/2/1: Propagation of improved pineapple clones of tissue culture. 1981. M. Fitchet

## WATER REQUIREMENTS/WATERBEHOEFTE

- SS.2482/31/1/1: Influence of irrigation on pineapple production. 1981. A.J. Alberts

## TECHNOLOGY/TEGNOLOGIE

- SS.2482/52/1/1: Problems with harvesting and post-harvest handling of pineapples. 1979. M. Fitchet

## CHEMISTRY/CHEMIE

- SS.2482/53/1/1: Nitrate contents of pineapple fruit for canning purposes. 1978. D. Millar-Watt

## AVOCADO/AVOKADO

## PHYSIOLOGY/FISIOLOGIE

- SS.2483/03/1/1: Abnormal graft unions of avocados. 1972. J.P. Bower  
SS.2483/03/1/2: Stock/scion relationship in avocados. 1981. J.P. Bower  
SS.2483/03/1/3: Physiological aspects of disease resistance in avocados. 1981. L.J. van Lelyveld  
SS.2483/03/1/4: Radioimmunoassay to determine true hormonal status of etiolated avocado stems. 1981. J.G.M. Cutting  
SS.2483/03/1/5: Radioimmunoassay to determine the hormonal status of alternate bearing avocado trees. 1981. J.G.M. Cutting  
SS.2483/03/1/6: Avocado physiology with emphasis on water relations. 1981. J.P. Bower  
SS.2483/03/1/7: The use of meristem shoot culture for avocados. 1983. J.P. Bower  
SS.2483/03/1/8: Biochemical studies on the enzymatic formation of ethylene in avocado. 1984. P.F. le Roux  
SS.2483/03/2/1: Development of tissue culture techniques for the production of embryogenic callus and protoplasts in avocados. 1984. P. Harty  
SS.2483/03/2/2: Development of shoot tip grafting technique in avocados. 1984. M. Nel  
SS.2483/03/2/3: Establishment and multiplication of rooted avocado plantlets in culture. 1984. P.A. Harry  
SS.2483/03/2/4: Development of callus and embryo cultures in avocado relatives. 1985. J.H. de Lange  
SS.2483/03/3/1: Physiological indicators for the prediction of quality of avocados. 1985. J.P. Bower  
SS.2483/03/3/2: Physiological indicators for the prediction of final harvest date of avocados. 1985. J.P. Bower

## NUTRITION/VOEDING

- SS.2483/05/1/1: Macro- and micro-element requirements of avocados. 1970. T.J. Koen

## PATHOLOGY/PATOLOGIE

- SS.2483/19/1/2: Resistance of avocado cultivars to root rot. 1972. J.N. Moll  
SS.2483/19/1/3: Chemical control of avocado root rot. 1984. J.A. Herbert  
SS.2483/19/2/1: Identification and control of avocado virus diseases. 1968. S.P. van Vuuren

PESTS/PLAE

SS.2483/20/1/1: Fruit fly studies on avocados. 1972. W.J. du Toit

CROP SCIENCE/GEWASKUNDE

SS.2483/30/1/1: Evaluation of avocado cultivar combinations in Natal. 1985. A.J. Joubert

TECHNOLOGY/TEGNOLOGIE

SS.2483/52/1/1: Improvement of the shelf life of avocados. 1963. B.J. Durand

SS.2483/52/1/2: Controlled- and modified-atmosphere storage of avocados. 1984. D.H. Swarts

BANANAS/PIESANGS

PHYSIOLOGY/FISIOLOGIE

SS.2484/03/2/1: Development of tissue culture techniques for the production of embryogenic callus and protoplasts in bananas. 1985. J.H. de Lange

NUTRITION/VOEDING

SS.2484/05/1/1: Optimum leaf analysis for bananas. 1970. W. Langenegger

UPGRADING/VEREDELING

SS.2484/07/1/1: The evaluation of promising banana selections. 1968. J.C. Robinson

PATHOLOGY/PATOLOGIE

SS.2484/19/1/1: Control of Panama wilt in bananas. 1976. J.F. Dames

PESTS/PLAE

SS.2484/20/1/1: Nematodes attacking bananas with special reference to the burrowing nematodes. 1972. E.C. Snyman

CROP SCIENCE/GEWASKUNDE

SS.2484/30/1/1: Determination of optimal plant population and spatial arrangements for bananas. 1980. J.C. Robinson

SS.2484/30/1/2: Crop timing and forecasting with bananas in relation to time of planting, sucker selection, spacing and locality. 1980. J.C. Robinson

WATER REQUIREMENTS/WATERBEHOEFTES

SS.2484/31/1/1: Investigation of irrigation schedules and systems for bananas. 1981. J.C. Robinson

TECHNOLOGY/TEGNOLOGIE

SS.2484/52/1/1: Improvement of the shelf life of bananas. 1975. D.H. Swarts

SS.2484/52/1/2: Controlled-atmosphere storage of bananas. 1983. D.H. Swarts

## DIVERSE SUBTROPICAL FRUITS/ALLERLEI SUBTROPIESE VRUGTE

### ANATOMY/ANATOMIE

- SS.2485/02/1/1: Diverse subtropical fruits: fruit development in the case of guavas. 1983. H.J. Parsons
- SS.2485/02/1/3: Flower and fruit development of diverse subtropical fruits with relation to papayas. 1985. A.D. Sippel

### PHYSIOLOGY/FISIOLOGIE

- SS.2485/03/1/1: Diverse subtropical fruits: flower and fruit development with relation to mangoes. 1972. P.D.F. Mullins
- SS.2485/03/1/2: Diverse subtropical fruits: radioimmunoassay of fruit development with mangoes. 1981. J.G.M. Cutting
- SS.2485/03/2/1: Diverse subtropical fruits: development of tissue culture techniques for the production of embryonic callus and protoplasts in granadillas. 1985. E. Louw
- SS.2485/03/2/2: Diverse subtropical fruits: development of a shoot tip grafting technique for granadillas. 1985. M. Nel
- SS.2485/03/3/1: Diverse subtropical fruit: development of tissue culture techniques for the production of embryonic callus and protoplasts in mangoes. 1985. J.H. de Lange
- SS.2485/03/4/1: Diverse subtropical fruits: clonal propagation of papayas *in vitro*. 1985. J.H. de Lange
- SS.2485/03/4/2: Diverse subtropical fruits: development of tissue culture techniques for the production of embryonic callus, protoplasts and haploid plants in papaya. 1985. J.H. de Lange

### NUTRITION/VOEDING

- SS.2485/05/1/2: Diverse subtropical fruits: macro- and micro-element requirements of guavas. 1981. G. Smart
- SS.2485/05/1/3: Diverse subtropical fruits: macro- and micro-element requirements of granadillas. 1973. G. Smart
- SS.2485/05/1/4: Diverse subtropical fruits: macro- and micro-element requirements of papayas. 1980. G. Smart
- SS.2485/05/1/5: Diverse subtropical fruits: macro- and micro-element requirements of mangoes. 1972. B.L. Smith

### UPGRADING/VEREDELING

- SS.2485/07/1/1: Diverse subtropical fruits: breeding and selection of relation to papayas. 1978. A.J. Joubert
- SS.2485/07/1/2: Diverse subtropical fruits: breeding and selection of relation to mangoes. 1971. J.C. Snyman
- SS.2485/07/1/3: Diverse subtropical fruits: breeding and selection of relation to guavas. 1970. C.P. Welgemoed
- SS.2485/07/1/4: Diverse subtropical fruits: breeding and selection of relation to litchis. 1981. A.J. Joubert

### PATHOLOGY/PATOLOGIE

- SS.2485/19/1/1: Diseases of diverse subtropical fruits: life cycle and control of bacterial black spot of mangoes. 1972. B.Q. Manicom
- SS.2485/19/1/2: Diverse subtropical fruits: life cycle and control of mango flower malformation. 1978. J.F. Dames



## Registered projects/Geregistreeerde projekte

- SS.2485/19/1/3: Diverse subtropical fruits: life cycle and control of blossom-end rot in guavas. 1982. N.M.G. Grech
- SS.2485/19/1/4: Diverse subtropical fruits: control of Malelane dieback in guavas. 1982. N.M.G. Grech
- SS.2485/19/1/5: Diverse subtropical fruits: control of damage by *Botrytis cinerea* on harvested guavas. 1984. D.H. Swarts
- SS.2485/19/1/6: Diseases of diverse subtropical fruits: identification and spread of the consil organism of mango blossom malformation. 1985. J.N. Moll

### PESTS/PLAE

- SS.2485/20/1/1: Diverse subtropical fruits: the occurrence and control of known and new pests. 1972. E.A. de Villiers

### CROP SCIENCE/GEWASKUNDE

- SS.2485/30/1/1: Diverse subtropical fruits: pruning times with relation to guavas. 1974. A.J. Alberts
- SS.2485/30/1/2: Diverse subtropical fruits: pruning systems with relation to guavas. 1974. A.J. Alberts
- SS.2485/30/1/3: Diverse subtropical fruits: alternative pruning systems with relation to guavas. 1985. A.J. Alberts
- SS.2485/30/2/1: Testing of diverse subtropical fruits in different localities. 1983. A.J. Joubert

### TECHNOLOGY/TEGNOLOGIE

- SS.2485/52/1/1: Diverse subtropical fruits: post-harvest handling with relation to mangoes. 1971. D.H. Swarts
- SS.2485/52/1/2: Diverse subtropical fruits: post-harvest handling with relation to papayas. 1971. D.H. Swarts

### CHEMISTRY/CHEMIE

- SS.2485/53/1/1: Diverse subtropical fruits: nature and relative occurrence of factors affecting growth in mango flowers with malformation. 1985. J.N. Moll

## OTHER SUBTROPICAL CROPS/ANDER SUBTROPIESE GEWASSE

### ANATOMY/ANATOMIE

- SS.2486/02/1/1: Other subtropical crops: flower and fruit formation studies with relation to bixa. 1980. M.W. Venter

### PHYSIOLOGY/FISIOLOGIE

- SS.2486/03/1/1: Other subtropical crops: meristem culture of ginger. 1985. J.H. de Lange

### NUTRITION/VOEDING

- SS.2486/05/1/1: Other subtropical crops: macro- and micro-element requirements of tea. 1975. B.L. Smith

### UPGRADING/VEREDELING

- SS.2486/07/1/1: Other subtropical crops: breeding and selection of tea. 1971. J.C. Snyman

### PESTS/PLAE

- SS.2486/20/1/1: Other subtropical crops: the occurrence and control of pests on tea. 1972. A. Schwartz

## Registered projects/Geregistreerde projekte

- SS.2486/20/2/1: Other subtropical crops: occurrence and control of root knot nematode species (*Meloidogyne*) infesting ginger. 1985. P. Willers

### CROP SCIENCE/GEWASKUNDE

- SS.2486/30/1/1: Planting distances for other subtropical crops with relation to coffee. 1980. K. de Rooster
- SS.2486/30/2/1: Testing of other subtropical crops in different localities. 1975. A.J. Joubert

### TECHNOLOGY/TEGNOLOGIE

- SS.2486/52/1/1: Other subtropical crops: effect of field practice and factory processes on black tea quality. 1984. L.J. van Lelyveld

### CHEMISTRY/CHEMIE

- SS.2486/53/1/1: Other subtropical crops: browning potential of tea clones and seedlings. 1984. L.J. van Lelyveld

## Nut crops/Neutgewasse

### NUTS/NEUTE

#### ANATOMY/ANATOMIE

- SS.2491/02/1/1: Anatomical studies in nuts: the pecan. 1981. T. Haulik

#### NUTRITION/VOEDING

- SS.2491/05/1/1: Macro- and micro-element requirements of macadamia nuts. 1968. L.L. Hoffmann
- SS.2491/05/1/2: Macro- and micro-element requirements of pecan nuts. 1969. T.J. Koen

#### PATHOLOGY/PATOLOGIE

- SS.2491/19/1/1: Control of scab on pecans. 1980. B.Q. Manicom
- SS.2491/19/2/1: Chemical control of anthracnose in macadamias. 1984. N.M. Grech

#### PESTS/PLAE

- SS.2491/20/1/1: The occurrence and control of pests on nut crops. 1972. E.A. de Villiers

### CROP SCIENCE/GEWASKUNDE

- SS.2491/30/1/1: Testing of macadamia cultivars in different localities. 1969. J.H. Oosthuysen
- SS.2491/30/1/2: Testing of pecan nut cultivars. 1971. A.J. Joubert
- SS.2491/30/1/3: Evaluation of macadamia nut cultivars in Natal Region. 1969. A.J. Joubert
- SS.2491/30/2/1: Testing of planting distances of macadamia nuts. 1971. J.H. Oosthuysen
- VV.2491/30/1/1: Second phase evaluation of almond cultivars in the Western Province. 1971. E.J. van Zyl

### CHEMISTRY/CHEMIE

- VV.2491/53/1/1: Nuts: effect of the changes in oil and anti-oxidants during storage on the taste of almonds. 1982. P.C. Fourie

## **Radioisotopes/Radioisotope**

### **RADIOISOTOPY/RADIOISOTOPIE**

#### **CHEMISTRY/CHEMIE**

- VV.24/01/53/1/2: Radiochemical separation of 28 Mg and 28 Al in a radioisotope generator. 1983. J.M. le Roux

#### **PHYSICS/FISIKA**

- VV.24/01/54/1/2: Determination of soil moisture and density near the soil surface with neutron and gamma-ray radioisotope techniques. 1979. J.H.M. Karsten

## **Sundry horticultural crops/Diverse tuinbougewasse**

### **HORTICULTURAL CROPS/TUINBOUGEWASSE**

#### **PHYSIOLOGY/FISIOLOGIE**

- VV.24/11/03/2/2: Propagation of dates by means of tissue culture. 1981. B. Ellis  
VV.24/11/03/3/1: Horticultural crops: vegetative propagation of difficult-to-root olive cultivars. 1983. C. Costa

#### **NUTRITION/VOEDING**

- VV.24/11/05/1/1: Horticultural crops: uptake of nutrients by olive leaves. 1982. O. Beukes  
VV.24/11/05/1/2: Horticultural crops: nitrogen, potassium and boron fertilisation of olives. 1981. J.A. Carreira  
VV.24/11/05/2/1: Horticultural crops: available phosphate and potassium for red tea. 1983. M.E. Joubert  
VV.24/11/05/3/1: Horticultural crops: seasonal uptake of nutrient elements by kiwi fruit. 1983. J.F. de Villiers

#### **UPGRADING/VEREDELING**

- VV.24/11/07/1/2: Horticultural crops: breeding of improved red tea types. 1977. J.H. Acker

#### **PATHOLOGY/PATOLOGIE**

- VV.24/11/19/1/1: The role of fungus pathogens in the early dieback of red tea. 1980. W.A. Smit

#### **CROP SCIENCE/GEWASKUNDE**

- VV.24/11/30/1/1: Horticultural crops: evaluation of imported olive cultivars in the Paarl, Clanwilliam and Robertson areas. 1981. R. Verbruggen  
VV.24/11/30/1/2: Horticultural crops: evaluation of olive mutations and seedlings in the Paarl and Robertson areas. 1982. J.A. van Zyl  
VV.24/11/30/1/3: Horticultural crops: evaluation of olive rootstocks in the Paarl and Robertson areas. 1982. C. Costa  
VV.24/11/30/2/1: Horticultural crops: planting and training systems for olives. 1982. J.A. van Zyl  
VV.24/11/30/2/2: Horticultural crops: crop control of olives in the Paarl area. 1982. J.A. van Zyl  
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- VV.24/11/30/8/2: Horticultural crops: second and third phase evaluation of kiwi fruit cultivars and selections in the summer rainfall area. 1985. L.L. van der Merwe
- VV.24/11/30/10/2: Horticultural crops: artificial rest breaking of kiwi fruit by climatological and chemical manipulation. 1984. G.C. Linsley-noakes

#### TECHNOLOGY/TEGNOLOGIE

- VV.24/11/52/1/1: Horticultural crops: influence of growing conditions on the quality of processed olives. 1982. P.C. Fourie
- VV.24/11/52/2/1: Horticultural crops: preparation for acceptable instant products from waste materials of red tea. 1983. E. Joubert

### PLANT PROTECTION RESEARCH/PLANTBESKERMINGSNAVORSING

#### Entomology/Zoology/Insektekunde/Dierkunde

##### INSECTS/INSEKTE

#### TAXONOMY/TAKSONOMIE

- PB.2511/01/1/1: Collection of southern African insects. 1910. G.L. Prinsloo
- PB.2511/01/1/3: Taxonomy of Tephritidae in southern Africa. 1922. H.K. Munro
- PB.2511/01/1/5: Taxonomy of parasitic wasps, Chalcidoidea. 1970. G.L. Prinsloo
- PB.2511/01/1/7: Taxonomy of Neuroptera. 1977. M.W. Mansell
- PB.2511/01/1/8: Taxonomy of Bruchidae. 1978
- PB.2511/01/1/9: Taxonomy of Hymenoptera Aculeata. 1978. C.D. Eardly
- PB.2511/01/1/10: Taxonomy of Cicadellidae of southern Africa. 1973. J.G. Theron
- PB.2511/01/1/11: Taxonomy and distribution of weevils (Curculionidae) in southern Africa. 1985. R.G. Oberprieler
- PB.2511/01/1/12: Taxonomy and distribution of Aphidoidea and Coccoidea in southern Africa. 1985. J.M. Millar

#### PESTS/PLAE

- PB.2511/20/1/1: Migratory locust control by aerial spray application. 1981. H.D. Brown
- PB.2511/20/1/2: The outbreak dynamics of the African migratory locust. 1981. H.D. Brown
- PB.2511/20/2/1: Insects: predators of the harvester termite, *Hodotermes mossambicus*. 1984. A. Nel
- PB.2511/20/2/2: Insects: bat-eared jackals (*Otocyon megalotis*) as consumers of harvester termites (*Hodotermes mossambicus*). 1984. A. Nel
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- PB.2511/22/2/1: The use of natural enemies to control stalk borers in cereal crops. 1978. H. van Hamburg

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- PB.2511/22/3/1: Development of a computerised data system for insect pests and their natural enemies. 1983. H. van Hamburg
- PB.2511/22/3/2: Handling and regulation of imported natural enemies of insect pests under quarantine conditions. 1983. H. van Hamburg

### INTEGRATED CONTROL/GEÏNTEGREERDE BEHEER

- PB.2511/23/1/1: Laboratory evaluation of candidate pesticides against the American bollworm. 1978. N.C.J. Basson
- PB.2511/23/1/2: The effect of pesticides applied under field conditions against *H. armigera* on natural enemies and red spider mite. 1978. N.C.J. Basson
- PB.2511/23/1/3: Pesticide resistance of *H. armigera* in South Africa. 1978. N.C.J. Basson
- PB.2511/23/1/5: The use of natural enemies to control *H. armigera*. 1978. H. van Hamburg
- PB.2511/23/1/6: The feeding behaviour of *Heliothis armigera* larvae and their impact on host plants. 1983. S.J. van der Walt
- PB.2511/23/1/7: The influence of rain and irrigation on the distribution and survival of *Heliothis armigera*. 1983. N.C.J. Basson
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- PB.2511/23/3/1: Evaluation of insecticides against insects which attack the spineless cactus. 1983. M.W. Pretorius

### NEMATODES/AALWURMS

#### TAXONOMY/TAKSONOMIE

- PB.2512/01/1/1: Collection of nematodes in southern Africa. 1962. Esther van den Berg
- PB.2512/01/1/3: Taxonomy of root knot nematodes, *Meloidogyne* spp. 1981. K.P.N. Kleynhans
- PB.2512/01/1/4: Taxonomic study of the South African Longidoridae. 1976. Esther van den Berg

#### PESTS/PLAE

- PB.2512/20/2/2: Occurrence and distribution of nematode pests in irrigation water. 1980. Antoinette P. van Miegheem

### MITES/MYTE

#### TAXONOMY/TAKSONOMIE

- PB.2513/01/1/1: Collection of mites of agricultural importance. 1959. Magdalena K.P. Meyer
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- PB.2513/01/1/3: Taxonomic free-living Acari, especially those belonging to the sub-order Mesostigmata. 1976. Magdalena K.P. Meyer

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- PB.2513/20/1/1: Laboratory evaluation of candidate pesticides against *Tetranychus* spp. 1978. D. Lombaard
- PB.2513/20/1/2: Evaluation of promising pesticides under field conditions against *Tetranychus* spp. 1978. J.H. Botha
- PB.2513/20/1/3: Determination of resistance of *Tetranychus* spp. to pesticides. 1978. D. Lombaard

SPIDERS/SPINNEKOPPE

TAXONOMY/TAKSONOMIE

PB.2514/01/1/1: Taxonomy of agriculturally important spiders. 1976. A.S. Dippenaar

RODENTS/KNAAGDIERE

PESTS/PLAE

PB.2515/20/1/1: The control of *Tatera brantsii* and *Praomys (Mastomys) natalensis*. 1969. Seugnet Stiemie

HONEY-BEE/HEUNINGBY

NUTRITION/VOEDING

PB.2516/05/1/2: Nectar and pollen flora of South Africa. 1969. M.F. Johannsmeier

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PB.2516/05/1/5: The effect of *Drosophila* spp. on nectar supply of *Eucalyptus* flowers. 1983. J.M. Herrmann

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PB.2516/07/1/1: The selection of improved breeding lines of honey-bees. 1972. R.H. Anderson

PATHOLOGY/PATOLOGIE

PB.2516/19/1/1: Diseases of the adult honey-bee. 1976. B. Buys

BEHAVIOURAL STUDIES/GEDRAGSTUDIES

PB.2516/28/1/1: The behaviour of honey-bees in orchards during pollination. 1972. R.H. Anderson

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PB.2516/29/1/1: The effect of honey-bees on sunflower pollination. 1985. A.P. du Toit

STORED GRAIN/OPGEBERGDE GRAAN

PESTS/PLAE

PB.2518/20/1/1: The use of contact material to control insects in stored grain and grain products. 1955. J.H. Viljoen

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- PB.2519/20/1/3: The biology, pest status and control of the black pine aphid. 1977. N.J. van Rensburg
- PB.2519/20/1/4: Forest and timber: the biology of the pine woolly aphid. 1982. W.A. Bruzas
- PB.2519/20/1/5: Forest and timber: the biology and behaviour of natural enemies of pine aphids. 1984. J.F. Kirsten
- PB.2519/20/1/6: Forest and timber: seasonal appearance of pine tree aphids in the Western Cape. 1985. J.K. Winstanley
- PB.2519/20/1/7: Forest and timber: biology and control of beetle pests of *Eucalyptus* spp. 1984. G.D. Tribe

## Plant pathology/Microbiology/Plantpatologie/Mikrobiologie

### FUNGI/SWAMME

#### TAXONOMY/TAKSONOMIE

- PB.2521/01/1/1: Identification of diverse fungi. 1973. C. Roux
- PB.2521/01/1/2: Edible, inedible and poisonous mushrooms, toadstools and other fungi. 1973. G.C.A. van der Westhuizen
- PB.2521/01/1/3: *Phialophora*-like fungi on roots of Gramineae. 1973. B. de Scott
- PB.2521/01/1/4: Taxonomy of fungi: Coelomycetes of South Africa. 1982. C. Roux
- PB.2521/01/1/5: The species of the fungus genus *Phytophthora* in South Africa. 1982. A.H. Thompson
- PB.2521/01/1/6: Taxonomy of fungi: *Fusarium* species in South Africa. 1984. R.Y. Anelich

#### MYCOLOGY/MIKOLOGIE

- PB.2521/11/1/1: Examination of diverse feeds for mycorrhizal fungi. 1978. C. Roux
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- PB.2521/11/2/1: Vesicular-arbuscular mycorrhizal fungi. 1982. B. de Scott
- PB.2521/11/2/2: Fungi associated with feeder root diseases of cereals. 1983. B. de Scott

#### PATHOLOGY/PATOLOGIE

- PB.2521/19/1/1: Pathogenic fungi on diverse seeds. 1975. M.A. Holtzhausen
- PB.2521/19/1/2: Seed-borne fungi of dry beans. 1982. A.P. Baxter
- PB.2521/19/1/3: Control of seed-borne fungal pathogens by infusion with chemicals. 1983. G.W. Herd
- PB.2521/19/2/5: Factors affecting survival, sporulation and infection by the fungus *P. cinnamomi*. 1985. Sharon L. von Broembsen
- PB.2521/19/2/6: Association of the fungus *P. cinnamomi* with decline and mortality of indigenous trees and shrubs. 1985. Sharon L. von Broembsen
- PB.2521/19/2/7: Control of root rot of pin cushions caused by the fungus *P. cinnamomi*. 1985. Sharon L. von Broembsen
- PB.2521/19/3/1: Epidemiology and control of diseases caused by the fungus *Sclerotinia sclerotiorum*. 1982. G.W. Herd
- PB.2521/19/3/2: Behaviour and survival of the fungal pathogen *Sclerotinia sclerotiorum* in cultivated soil. 1983. A.J.L. Phillips
- PB.2521/19/4/1: Host range, distribution and pathogenicity of the fungus *B. dothidea*. 1985. J.A. van der Merwe

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- PB.2521/19/4/2: Factors affecting sporulation, infection and disease development by the fungus *B. dothidea*. 1985. J.A. van der Merwe
- PB.2521/19/4/3: Control of canker and dieback of cut-flower proteas caused by the fungus *B. dothidea*. 1985. J.A. van der Merwe
- PB.2521/19/5/1: Host range, distribution and pathogenicity of the fungus *D. dematioidea*. 1985. Sharon L. von Broembsen
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- PB.2521/19/5/3: Control of pin cushion blight caused by the fungus *D. dematioidea*. 1986. Sharon L. von Broembsen

## BACTERIA/BAKTERIEë

### NITROGEN FIXATION/STIKSTOFBINDING

- PB.2522/09/1/1: Testing of commercial bacterial inoculants for legumes. 1967. B.W. Strijdom
- PB.2522/09/1/2: Selection of *Rhizobium* bacteria for inoculants. 1968. C.J. Otto
- PB.2522/09/1/3: Role of lectins in specificity of *Rhizobium* bacteria. 1975. I.J. Law
- PB.2522/09/1/4: Relative importance of nitrogen-fixing ability when selecting *Rhizobium* bacteria for inoculants. 1976. H. Jansen van Rensburg
- PB.2522/09/1/9: Application of nitrogen fixing bacterial inoculants to legumes through irrigation systems. 1983. J.L. Staphorst
- PB.2522/09/1/10: Development of immunological methods for quality control of legume inoculants containing bacteria. 1985. H.H. Lochner
- PB.2522/09/1/11: Bacteria: possible utilisation of liquid *Rhizobium* inoculant. 1985. C.J. Otto
- PB.2522/09/1/12: Bacteria: investigation of problems experienced with inoculation of pasture legumes. 1985. J.L. Staphorst
- PB.2522/09/1/13: Bacteria: investigation of problems experienced with inoculation of grain legumes. 1985. J.L. Staphorst

### BIOLOGICAL CONTROL/BIOLOGIESE BEHEER

- PB.2522/22/1/1: Bacteria: isolation, identification and biotyping of *Agrobacterium* spp. from plants and soil. 1985. F.G.H. van Zyl
- PB.2522/22/1/2: Bacteria: the determination of agrocin production and sensitivity of local pathogenic and non-pathogenic *Agrobacterium* species. 1985. F.G.H. van Zyl
- PB.2522/22/1/3: Bacteria: the evaluation of D286 as control strain for crown gall, where K84 appears to be unsuccessful. 1985. F.G.H. van Zyl
- PB.2522/22/1/4: Bacteria: the role of competition and specificity of the plant cell binding sites in the biological control of crown gall. 1985. J.L. Staphorst
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- PB.2522/22/1/6: Bacteria: the determination of factors in the Boland that is responsible for the possible suppression of crown gall on grapevine. 1985. F.G.H. van Zyl

## VIRUSES/VIRUSSE

### PATHOLOGY/PATOLOGIE

- PB.2523/19/1/1: Investigation on the virus nature of grapevine leafroll disease. 1985. D.J. Engelbrecht

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- PB.2523/19/1/2: Investigations on the mealybug transmission of viruses associated with grapevine leafroll disease. 1985. D.J. Engelbrecht
- PB.2523/19/1/3: Development of immunological virus detection procedures for grapevine diseases. 1985. D.J. Engelbrecht
- PB.2523/19/1/4: Development of nucleic acid coupled virus detection procedures for grapevine diseases. 1985. R. Human

## PLANT DISEASES/PLANTSIEKTES

### PATHOLOGY/PATOLOGIE

- PB.2524/19/1/1: Data bank of diseases of plants handled by the quarantine station at Stellenbosch. 1980. P. von Maltitz

## FOREST AND TIMBER/BOSBOME EN TIMMERHOUT

### PATHOLOGY/PATOLOGIE

- PB.2525/19/1/1: Routine examination of diseased material from forest trees. 1975. M.J. Wingfield
- PB.2525/19/1/2: Survey of diseases of forest trees in plantations. 1975. M.J. Wingfield
- PB.2525/19/1/3: Survey of diseases in forest tree nurseries. 1975. M.J. Wingfield
- PB.2525/19/1/4: Techniques for disease assessment in forest trees. 1983. J.E. Lundquist
- PB.2525/19/1/5: Selection and screening forest trees for disease resistance. 1983. J.E. Lundquist
- PB.2525/19/1/6: Integrated control of forest tree diseases. 1983. J.E. Lundquist
- PB.2525/19/2/1: Forest and timber: pathogenicity host range and spread of *Verticicladiella* spp. causing root diseases of pines. 1985. M.J. Wingfield
- PB.2525/19/3/1: Forest and timber: host range and spread of *Diplodia pinea* on pines in South Africa. 1985. W.J. Swart
- PB.2525/19/3/2: Forest and timber: production and liberation of conidia by *Diplodia pinea*. 1985. W.J. Swart
- PB.2525/19/4/1: Forest and timber: the occurrence and vector associations of *Ceratocystis* species on forest trees. 1985. M.J. Wingfield
- PB.2525/19/5/1: Forest and timber: host range, pathogenicity and distribution of *Mycosphaerella* needle disease of pines. 1986. M.J. Wingfield
- PB.2525/19/10/1: Forest and timber: routine diagnoses of forest tree diseases in Transvaal. 1985. J.E. Lundquist

## PASTURE CROPS/WEIDINGSGEWASSE

### PATHOLOGY/PATOLOGIE

- PB.2526/19/1/2: Survey of diseases of planted leguminous pasture crops in the summer rainfall areas. 1979. L.J. Mills
- PB.2526/19/1/4: Occurrence and distribution of pasture crop diseases in the Western Cape: *Medicago* spp. 1982. S.C. Lamprecht
- PB.2526/19/1/5: Evaluation of disease resistance in the Western Cape - *Medicago* spp. 1982. S.C. Lamprecht
- PB.2526/19/1/6: *Phytophthora* root rot of the pasture crop lucerne. 1982. A.H. Thompson
- PB.2526/19/1/7: Evaluation of imported cultivars of the pasture crop lucerne for disease resistance. 1983. A.H. Thompson



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- PB.2526/19/1/8: Evaluation of resistance of leguminaceous pasture crops to fungal diseases. 1983. L.J. Mills
- PB.2526/19/1/9: Pasture crops: seed-borne fungal pathogens and disease transmission by seed of *Medicago* spp. 1986. S.C. Lamprecht
- PB.2526/19/1/10: Pasture crops: survival and infection of *Fusarium avenaceum* on annual *Medicago* spp. 1986. S.C. Lamprecht
- PB.2526/19/1/11: Pasture crops: the role of *Fusarium* in a wheat-medic crop rotation system. 1986. S.C. Lamprecht
- PB.2526/19/1/12: Pasture crops: yield losses by and resistance to *Colletotrichum* crown rot of lucerne cultivars in the Cape Province. 1985. S.H. Koch
- PB.2526/19/1/13: Pasture crops: assessment of disease resistance of cultivated lucerne cultivars to above and below ground pathogens in South Africa. 1986. S.C. Lamprecht

## Phytosanitary research and activities/Fitosanitiere navorsing en aktiwiteite

### VIRUSES/VIRUSSE

#### PATHOLOGY/PATOLOGIE

- PB.2531/19/1/3: Detection and identification of virus diseases of deciduous fruit. 1970. J. Thatcher
- PB.2531/19/2/1: Routine identification of virus diseases in plants, excluding leguminous and grass crops. 1980. G. Pietersen
- PB.2531/19/2/2: Virus diseases of cassava, *Manihot esculenta*. 1980. G. Pietersen
- PB.2531/19/2/3: Detection and identification of seed-borne virus diseases of forage and pasture legumes. 1980. G. Pietersen
- PB.2531/19/2/4: Virus diseases of maize. 1980. G. Pietersen

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#### PATHOLOGY/PATOLOGIE

- PB.2532/19/1/4: Diagnosis of bacterial diseases of phytosanitary importance on propagation material. 1982. P.M. von Maltitz
- PB.2532/19/1/5: Development of standard isolation and identification procedures for bacterial pathogens of phytosanitary importance. 1982. P.M. von Maltitz
- PB.2532/19/1/6: Elimination of bacterial plant pathogens of phytosanitary importance from propagation material. 1982. P.M. von Maltitz
- PB.2532/19/1/8: Development of agrocin-producing strains of *Agrobacterium tumefaciens*. 1984. F.G.H. van Zyl

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- PB.2533/19/1/1: Detection of fungal diseases of phytosanitary importance on propagation material. 1982. P.M. von Maltitz
- PB.2533/19/1/2: Development of standard procedures for isolation and identification of fungal pathogens of phytosanitary importance. 1982. P.M. von Maltitz
- PB.2533/19/1/3: Elimination of fungal plant pathogens of phytosanitary importance from propagation material. 1982. P.M. von Maltitz

INSECTS/INSEKTE

PESTS/PLAE

- PB.2534/20/1/1: Data bank of insect pests of plants handled by the Stellenbosch quarantine station. 1984. A.J. Els

Electron microscopy/Elektronmikroskopie

ELECTRON MICROSCOPY/ELEKTRONMIKROSKOPIE

TECHNOLOGY/TEGNOLOGIE

- PB.2541/52/1/1: Preparation and examination of biological specimens by electron microscopy. 1979. H.J. van Tonder

Weed research/Onkruidnavorsing

WEEDS/ONKRUIDE

PHYSIOLOGY/FISIOLOGIE

- PB.2551/03/1/1: Physiology of veld invader weeds' seed germination. 1981. J.L. Graaf  
PB.2551/03/2/1: Uptake and translocation of herbicides by the weed bramble (*Rubus* spp.). 1981. D.J. Erasmus

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- PB.2551/21/1/1: Chemical control of the weed jointed cactus (*Opuntia aurantiaca*). 1960. H.G. Zimmermann  
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- PB.2551/22/1/1: Biological control of the weed jointed cactus (*Opuntia aurantiaca*). 1960. H.G. Zimmermann  
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## Registered projects/Geregistreerde projekte

PB.2551/22/2/1: A study of the diseases of some indigenous and exotic weeds which are caused by local pathogens. 1979. M.J. Morris

PB.2551/22/2/2: Biological control of *Acacia* weeds by means of pathogens. 1982. M.J. Morris

## ECOLOGY/EKOLOGIE

PB.2551/27/1/1: Ecology of the weed *Acacia longifolia*. 1983. P.J. Pieterse

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## PESTICIDES/PLAAGDODERS

## PHYSIOLOGY/FISIOLOGIE

PB.2552/03/1/2: Effect of pesticide breakdown in soils on phytotoxicity. 1984. E.R.I.C. Sandmann

PB.2552/03/1/3: A study of climatic factors potentiating pesticide phytotoxicity in legumes. 1984. E. van Rensburg

## BIOTESTING/BIOTOETSING

PB.2552/24/1/1: The use of an algal bioassay to determine concentrations of phytosynthetic-inhibiting herbicides. 1985. J.L. Graaf

PB.2552/24/1/2: The use of plant cells and plant tissue culture to determine herbicide concentrations. 1985. J.L. Graaf

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## CHEMISTRY/CHEMIE

PB.2552/53/1/2: Improvement of chromatographic resolution of pesticides. 1981. P.R. de Beer

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PB.2552/53/1/5: Analysis of pesticides and their residues affecting useful plants. 1983. P. Niewoudt

PB.2552/53/1/6: Research and improvement of pesticide analysis done by the WGPA. 1984. P.R. de Beer

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## **ANIMAL PRODUCTION PROMOTION/DIERE- PRODUKSIEBEVORDERING**

### **ANIMAL PRODUCTION AND ANIMAL PRODUCTS RESEARCH/ DIEREPRODUKSIE- EN DIEREPRODUKTENAVORSING**

#### **Animal production/Diereproduksie**

##### **BEEF CATTLE/VLEISBEESTE**

###### **UPGRADING/VEREDELING**

- VS.3111/07/1/1: Evaluation of beef bulls in upgrading: Bonsmara. 1980. D.J. Bosman
- VS.3111/07/1/2: Beef cattle: evaluation of the Roodebos and Wesselsvlei Bonsmara breeding lines. 1982. D.J. Bosman
- VS.3111/07/1/3: Upgrading studies on beef cattle - improving fertility by natural selection. 1984. M.M. Scholtz
- VS.3111/07/1/4: Upgrading studies on beef cattle: the effects of selection for growth under different management systems on production efficiency. 1985. J. van der Westhuizen
- VS.3111/07/1/5: Upgrading studies on beef cattle: a genetic study of the 1/29 chromosome translocation in the progeny of a heterozygote Brahman bull. 1985. N.D. Nel
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- VS.3111/07/1/7: Beef cattle: prediction of breeding values and quantification of genetic trends using mixed model procedures. 1985. C. Hunlun

##### **DAIRY CATTLE/MELKBEESTE**

###### **PHYSIOLOGY/FISIOLOGIE**

- VS.3112/03/1/1: An investigation into *in vitro* culture techniques for hormone dependent mammary gland tissue in dairy cattle. 1983. J.P. van Zyl
- VS.3112/03/1/2: Milk prolactin surge before and during parturition and production parameters in dairy cattle. 1983. J.P. van Zyl

###### **REPRODUCTION/REPRODUKSIE**

- VS.3112/04/1/1: Milk progesterone in dairy cattle reproduction - pregnancy. 1982. G.W. Kay

###### **NUTRITION/VOEDING**

- VS.3112/05/1/3: Ureum in complete diets for dairy cattle. 1982. L.J. Erasmus
- VS.3112/05/1/5: Dairy cattle nutrition: establishment of a degradability data base. 1985. L.J. Erasmus
- VS.3112/05/1/6: Dairy cattle: sorghum grain for lactating dairy cows. 1985. L. Möller
- VS.3112/05/1/7: Dairy cattle nutrition: strategic protein nutrition of high producing cows. 1985. B. Ferreira

###### **GENETICS/GENETIKA**

- VS.3112/06/1/1: Genetic aspects of laminitis in dairy cattle. 1965. E.H.H. Meyer

**UPGRADING/VEREDELING**

- VS.3112/07/1/1: Genetic variation in milk and butterfat production in the upgrading of dairy cattle. 1965. G.P. Kuhn
- VS.3112/07/1/3: Milkability and milk quality characteristics in the upgrading of dairy cattle. 1971. J.H. Hofmeyr

**MANAGEMENT/BESTUUR**

- VS.3112/41/1/1: Biological economic data-analysing service for dairy cattle. 1981. M.H. Neitz

**MUTTON SHEEP/VLEISSKAPE**

**REPRODUCTION/REPRODUKSIE**

- VS.3113/04/1/1: Mutton sheep reproduction: short scrotum castration. 1977. J.P.C. Greyling

**UPGRADING/VEREDELING**

- VS.3113/07/1/1: Upgrading of mutton sheep: quantification of genetic and non-genetic components of maternal effects. 1985. J.C. Greeff

**WOOLLED SHEEP/WOLSKAPE**

**UPGRADING/VEREDELING**

- VS.3114/07/1/1: Skin and fibre characteristics in the upgrading of woolled sheep. 1972. J.H. Dreyer
- VS.3114/07/2/1: Upgrading of reproduction characteristics of woolled sheep by means of cross-breeding. 1972. J.H. Hofmeyr
- VS.3114/07/2/2: Upgrading of woolled sheep crosses: evaluation of the Gotlander and its crosses for carpet wool production. 1985. J.C. Greeff

**PELT SHEEP/PELSSKAPE**

**REPRODUCTION/REPRODUKSIE**

- VS.3115/04/1/1: Reproduction aspects in pelt sheep: freezing of Karakul semen. 1971. J.P.C. Greyling

**UPGRADING/VEREDELING**

- VS.3115/07/1/1: Upgrading of pelt sheep - white Karakuls. 1980. J.H. Hofmeyr

**MEAT GOATS/VLEISBOKKE**

**REPRODUCTION/REPRODUKSIE**

- VS.3117/04/1/1: Reproduction in the Boer goat: freezing of Boer goat semen. 1974. J.P.C. Greyling
- VS.3117/04/1/2: Reproduction in the meat goat: Boer goats. 1980. J.P.C. Greyling

**PIGS/VARKE**

**REPRODUCTION/REPRODUKSIE**

- VS.3119/04/1/3: Pigs: reproduction in gilts - puberty. 1982. C. Kemp
- VS.3119/04/1/4: Pigs: reproduction in boars - seasonal growth. 1982. C. Kemp

## NUTRITION/VOEDING

- VS.3119/05/1/2: Dehydrated lucerne in pig production. 1979. E.H. Kemm  
VS.3119/05/1/3: Protein deposition in pig nutrition. 1980. F.K. Siebrits  
VS.3119/05/1/5: Pig nutrition: the "ideal protein" requirements of the growing pig. 1984. E.H. Kemm  
VS.3119/05/1/6: Pig nutrition: qualitative and quantitative aspects and implications of wheat as feed source. 1984. F.K. Siebrits

## UPGRADING/VEREDELING

- VS.3119/07/1/2: Upgrading of pigs: biochemical genetic typing for identification and parentage control. 1985. A. Swanepoel

## CHICKENS/HOENDERS

### NUTRITION/VOEDING

- VS.31110/05/1/1: Nutrition of laying fowls - influence of calcium on phosphorus requirements. 1977. J. Erasmus  
VS.31110/05/1/2: Nutrition of laying fowls - lysine requirements. 1976. J. Erasmus  
VS.31110/05/1/3: Nutrition of laying fowls - seasonal energy and protein levels. 1975. J. Erasmus  
VS.31110/05/1/4: The use of grain sorghum (*Sorghum vulgare*) in chicken diets. 1982. I.P. Swart

### UPGRADING/VEREDELING

- VS.31110/07/1/1: Upgrading of laying fowls - sex-linked feather colour. 1972. G.F. Potgieter  
VS.31110/07/1/2: Upgrading of laying fowls - red or gold feather colour. 1971. G.F. Potgieter  
VS.31110/07/1/3: Upgrading of laying fowls - combining activity. 1971. G.F. Potgieter  
VS.31110/07/1/4: Upgrading of laying fowls - Australorp. 1971. G.F. Potgieter  
VS.31110/07/1/5: Upgrading of laying fowls - other breeds. 1972. G.F. Potgieter  
VS.31110/07/1/6: Upgrading of laying fowl breeds - New Hampshire control flock. 1976. J.J. Joubert  
VS.31110/07/1/7: Genotype environment interaction in laying fowls - upgrading of laying fowl breeds. 1976. J.J. Joubert  
VS.31110/07/2/1: Upgrading of meat type male line fowls. 1975. J.J. Joubert  
VS.31110/07/2/2: Upgrading of meat type hen line fowls. 1962. J.J. Joubert

## OTHER POULTRY/ANDER PLUIMVEE

### NUTRITION/VOEDING

- VS.31115/05/1/1: Nutrient requirement of other poultry - Chinese geese. 1965. M.D. Olver  
VS.31115/05/1/2: Nutrient requirement of other poultry feeding systems - ducks. 1977. M.D. Olver

### UPGRADING/VEREDELING

- VS.31115/07/1/1: Upgrading of other poultry - Hagedoorn system with ducks. 1965. M.D. Olver



## Animal products/Diereprodukte

### MEAT/VLEIS

#### NORM STUDIES/NORMSTUDIES

- VS.3121/50/1/1: Meat production: skeletal muscle development - cattle. 1973. P.H. Heinze
- VS.3121/50/1/2: Meat production: carcass evaluation - cattle. 1975. R.T. Naudé
- VS.3121/50/1/3: Meat production: chilling of beef carcasses. 1976. R.T. Naudé
- VS.3121/50/1/4: Meat production: carcass grading system - cattle. 1976. R.T. Naudé
- VS.3121/50/1/8: Meat production: carcass grading system - small stock. 1981. G.G. Bruwer
- VS.3121/50/1/9: Meat production: compensatory growth - cattle. 1982. J.F. du Bruyn
- VS.3121/50/1/10: Meat production: microbiology of packed meat. 1981. G.L. Nortjé
- VS.3121/50/1/11: Meat production: porcine stress syndromes. 1984. P.H. Heinze
- VS.3121/50/1/12: Meat production: the influence of vacuum packaging films on beef quality. 1984. H.F.O. Bekker

### MILK/MELK

#### MICROBIOLOGY/MIKROBIOLOGIE

- VS.3123/08/1/2: Rapid tests for the bacterial evaluation of milk. 1982. W.C. Botha
- VS.3123/08/1/3: Comparison of tests for determining the number of total coliforms and faecal coliforms in milk. 1983. H.H.A. Lück
- VS.3123/08/1/4: Evaluation of the plate loop method for determining the total bacterial count of refrigerated milk. 1983. H.H.A. Lück
- VS.3123/08/1/5: Milk: preservation of milk samples for bacterial count tests. 1983. H.H.A. Lück
- VS.3123/08/1/6: Milk: statistical evaluation of automatic bacterial colony counters. 1983. H. Gavron
- VS.3123/08/3/2: The shelf life of aseptical-packaged pasteurised milk. 1983. J.F. Mostert
- VS.3123/08/3/3: The suitability of a self-service dispenser for retail distribution of milk. 1984. H.H.A. Lück
- VS.3123/08/4/2: Milk: assay of antibiotics. 1983. H. Gavron

#### CHEMISTRY/CHEMIE

- VS.3123/53/1/2: Glucose content of milk as influenced by the stage of lactation milk yield energy intake and somatic cell count. 1982. H.H.A. Lück
- VS.3123/53/2/1: Discolourisation of UHT-milk. 1981
- VS.3123/53/4/1: Natural and added iodine in milk. 1981. L.E. Smit

### DAIRY PRODUCTS/SUIWELPRODUKTE

#### MICROBIOLOGY/MIKROBIOLOGIE

- VS.3124/08/1/1: Dairy products: a genetic study of the group *N. streptococci*. 1981. H. Gavron
- VS.3124/08/1/3: Dairy products: bacterial content of air in dairy factories. 1983. H.H.A. Lück
- VS.3124/08/1/4: Dairy products: the influence of gas-producing heterofermentative *Lactobacilli* on the texture of cheese. 1983. H.H.A. Lück

## Registered projects/Geregistreeerde projekte

- VS.3124/08/2/2: Dairy products: the influence of non-starter organisms on Cheddar cheese. 1983. A.J. Kruger
- VS.3124/08/2/3: Control of insect infestation during storage of dairy products. 1984. H.H.A. Lück
- VS.3124/08/3/4: Enterotoxic *Escherichia coli* in dairy products. 1982. H.H.A. Lück
- VS.3124/08/3/5: Dairy products: the evaluation of pathogenic bacteria in milk and cheese. 1983. H. Gavron

### NORM STUDIES/NORMSTUDIES

- VS.3124/50/1/1: Dairy products: production and quality of butter in South Africa. 1981. J.J. du Toit
- VS.3124/50/1/2: Dairy products: production and quality of ice-cream in South Africa. 1983. J.J. Keller

### TECHNOLOGY/TEGNOLOGIE

- VS.3124/52/1/1: Dairy products: technique studies in the concentration of whey and skim milk by ultrafiltration. 1983. T.E.H. Downes
- VS.3124/52/1/2: The use of products recovered by ultrafiltration in dairy products. 1972. T.E.H. Downes
- VS.3124/52/1/3: Dairy products: the hidrolisates of whey proteins. 1983
- VS.3124/52/1/5: Dairy products: the development of a low-energy dairy spread with favourable spreadability. 1982. T.E.H. Downes
- VS.3124/52/1/6: Dairy products: demineralisation, processing and utilisation of cheese whey. 1982. T.E.H. Downes
- VS.3124/52/1/10: Hydrolysis of lactose in cheese whey for use in dairy products or other foods. 1984. T.E.H. Downes
- VS.3124/52/2/1: Dairy products: criteria to determine the degree of ripening of cheese. 1976. J.A. Nieuwoudt

### CHEMISTRY/CHEMIE

- VS.3124/53/1/3: Dairy products: the influence of psychrotrophic organisms on the manufacturing and ripening of Cheddar cheese. 1983. T.E.H. Downes
- VS.3124/53/2/1: Dairy products: the discolourisation of coloured fermented milk drinks. 1982. J.F. Mostert
- VS.3124/53/2/3: Dairy products: determination of proteinases in cheese. 1984. M.E. Seppä
- VS.3124/53/2/4: Dairy products: isolation of proteinases from cheese. 1984. M.E. Seppä
- VS.3124/53/3/1: Dairy products: methods to determine the degree of added milk powder to bread. 1981. L.E. Smith
- VS.3124/53/3/2: The determination of the biological values of proteins in dairy products according to the tetrahymena-assay technique. 1981. J.P. Ireland
- VS.3124/53/3/4: Dairy products: the identification of milk proteins in other foods. 1983. C.M. Potgieter
- VS.3124/53/3/5: Dairy products: the quantitative determination of added whey protein to milk powder. 1983. C.M. Potgieter
- VS.3124/53/3/6: Levels of linoleic acid (trans) in dairy products and oils before and after processing. 1984. L.D. Nourse
- VS.3124/53/3/7: Dairy products *versus* processed oils as fat-energy source: the disturbance of the metabolism of all cis-linoleic acid by the transforms as measured by growth of broiler chicks. 1984. L.D. Nourse
- VS.3124/53/3/8: Dairy products *versus* processed oils as fat-energy source: the disturbance of the metabolism of all cis-linoleic acid by the transforms as measured by uncontrolled cell proliferation in tissue cultures. 1984. L.D. Nourse
- VS.3124/53/3/9: The incidence of heavy metals in dairy products. 1985. D.J.W. Bester

**Supporting animal research/Ondersteunende veekundige navorsing**

ANIMALS/DIERE

REPRODUCTION/REPRODUKSIE

VS.3133/04/1/1: Reproduction aspects in female farm animals: Bonsmara, Angora. 1984. G.W. Kay

NUTRITION/VOEDING

- VS.3133/05/1/6: Feed intake in the nutrition of farm animals - feed characteristics. 1981. J.P. Pienaar
- VS.3133/05/1/7: Simultaneous measurement of the components in the energy metabolism of farm animals. 1982. J. Viljoen
- VS.3133/05/1/8: Animals: relationship between rumen fill and energy balance on roughage diets. 1983. P.H. Henning
- VS.3133/05/1/9: Feed intake in the nutrition of farm animals - growth studies with beef steers under production conditions. 1984. J.P. Campher
- VS.3133/05/1/10: Feed intake in the feeding of farm animals: quantification of digestive energy losses on different ruminant diets. 1984. N. Slabbert
- VS.3133/05/1/11: Feed intake parameters in the feeding of farm animals: chromium mordant as a particle marker. 1985. J.P. Pienaar
- VS.3133/05/2/2: Quality of blood and carcass meals in the nutrition of non-ruminant animals. 1978. G.A. Smith
- VS.3133/05/2/4: The influence of starch to nitrogen ratios on *in situ* protein degradation in animal nutrition. 1983. P.B. Cronjé
- VS.3133/05/2/5: Protein nutrition: protein turnover in muscle tissue of growing rats. 1984. C.D. Esterhuysen
- VS.3133/05/3/1: Digestive physiology and metabolism aspects in the feeding of farm animals - bacteria, solid-particles attachment. 1968. R.I. Mackie
- VS.3133/05/3/2: Digestive physiology and metabolism aspects in feeding of farm animals - bacteria, teff hay. 1969. R.I. Mackie
- VS.3133/05/3/3: Digestive physiology and metabolism aspects in the feeding of farm animals - bacteria biuret. 1973. R.I. Mackie
- VS.3133/05/3/4: Digestive physiology and metabolism aspects in the feeding of farm animals - glucose production. 1975. J.G. van der Walt
- VS.3133/05/3/5: Digestive physiology and metabolism aspects in the feeding of farm animals - bacteria, solid-particle separation. 1976. R.I. Mackie
- VS.3133/05/3/6: Digestive physiology and metabolism aspects in feeding of farm animals - proteolytic bacteria. 1976. R.I. Mackie
- VS.3133/05/3/8: Digestive physiology and metabolism aspects in the feeding of farm animals - bacteria, lactic acid. 1976. R.I. Mackie
- VS.3133/05/3/9: Digestive physiology and metabolism aspects in the feeding of farm animals - glucose tolerance. 1976. J.G. van der Walt
- VS.3133/05/3/10: Digestive physiology and metabolism aspects in the feeding of farm animals - fasting. 1977
- VS.3133/05/3/12: Digestive physiology and metabolism aspects in the feeding of farm animals - bacterial growth, Na<sup>+</sup> and K<sup>+</sup>. 1980
- VS.3133 05 3 13: Digestive physiology and metabolism aspects in the feeding of farm animals - tissue lipogenic precursors. 1982. J.G. van der Walt



## Registered projects/Geregistreerde projekte

- VS.3133/05/3/14: Digestive physiology and metabolism aspects in animal feeding - growth constants, cellulolytic bacteria. 1973. A. Kistner
- VS.3133/05/3/15: Digestive physiology and metabolism aspects in animal feeding - microbial and feed protein. 1975. H.M. Schwartz
- VS.3133/05/3/16: Digestive physiology and metabolism aspects in animal feeding - fibre-digesting bacteria. 1979. Y. van der Linden
- VS.3133/05/3/17: Digestive physiology and metabolism aspects in the feeding of farm animals: ammonia transport and its influence on nitrogen metabolism in rumen bacteria. 1984. Johanna J. Therion
- VS.3133/05/3/18: Digestive physiology and metabolism aspects in the feeding of farm animals: regulation and control of proteases in pure cultures of rumen bacteria. 1984. E. Strydom
- VS.3133/05/3/19: Animals: influence of lactation and nutrition on the metabolism of lipogenic precursors. 1985. S.L. Campbell
- VS.3133/05/4/1: NaOH-treated wheat straw. 1977. H.S. Hofmeyr
- VS.3133/05/4/4: Crop residues of by-products for animal nutrition - pigs and poultry. 1982. E.H. Kemm
- VS.3133/05/6/1: Dietary components in feeds for animal feeding: processed maize. 1978
- VS.3133/05/6/5: Dietary components in feeds for animal feeding: whole maize grain. 1984. J.P. Campher
- VS.3133/05/6/6: Dietary components in feeds for animal feeding: combinations of energy sources. 1985. P.H. Henning

## GENETICS/GENETIKA

- VS.3133/06/1/1: Genetic defects in farm animals - hipoplasies cattle. 1979. E.H.H. Meyer
- VS.3133/06/1/2: Genetic aspects of polymorphism in farm animals - milk polymorphism. 1977. E.H.H. Meyer
- VS.3133/06/1/3: Genetic aspects of haemoglobins in farm animals - cattle. 1977. E.H.H. Meyer
- VS.3133/06/1/4: Genetic aspects of blood typing in farm animals. 1969. S.J. du Plessis.
- VS.3133/06/1/5: Genetic production models for farm animals - milk production. 1977. C.Z. Roux
- VS.3133/06/1/6: Laboratory animals in genetic studies: efficiency of feed utilisation. 1978. M.M. Scholtz
- VS.3133/06/1/7: Breeding of laboratory animals in genetic studies. 1977. E.H.H. Meyer
- VS.3133/06/1/8: Laboratory animals in genetic studies - life time growth. 1981. C.Z. Roux
- VS.3133/06/1/9: Genetic aspects of karyotyping in farm animals. 1978. E.H.H. Meyer
- VS.3133/06/1/10: Laboratory animals in genetic studies: milk production estimation techniques - rats. 1982. M.M. Scholtz
- VS.3133/06/1/11: The genetic maintenance of small animal populations and the effect of in-breeding on production characteristics. 1982. J.C. Greeff
- VS.3133/06/1/12: Genetic studies on farm animals: preparation of monospecific anti-sera against lymphocyte antigens for investigation into the immune system of cattle. 1985. J. Bester
- VS.3133/06/1/13: Genetic studies on farm animals: development of biochemical methodology for antigen characterisation with regard to genetic aspects of the immune system. 1985. M.C. Field

## UPGRADING/VEREDELING

- VS.3133/07/1/1: Upgrading studies on indigenous animals - maintenance, evaluation and improvement of indigenous Sanga cattle. 1982. M.M. Scholtz

- VS.3133/07/1/2: Upgrading studies on indigenous animals - cytogenetic studies on Nguni cattle. 1982. N.D. Nel
- VS.3133/07/1/3: Upgrading of animals: the evaluation of highly fertile sheep - breeds and strains in crosses. 1982. J.C. Greeff
- VS.3133/07/1/5: Animals: genetic aspects of protein and enzyme polymorphism in sheep and goats. 1985. M.C. Field

## VETERINARY RESEARCH/VEEARTSENYKUNDIGE NAVORSING

### Pathological investigations/Patologiese ondersoeke

#### PATHOLOGICAL INVESTIGATIONS/PATOLOGIESE ONDERSOEKE

##### PATHOLOGY/PATOLOGIE

- OP.3211/19/1/1: Diagnostic pathological investigations into mortalities of animals through macro- and microscopical techniques. 1981. J.A.W. Coetzer
- OP.3211/19/1/2: Diagnostic investigations into mortalities through electron microscopical techniques. 1981. L. Prozesky
- OP.3211/19/2/3: Pathological investigations on and pathogenesis of African swine fever. 1981. J.A. Naser
- OP.3211/19/2/4: Pathological investigations on and pathogenesis of *Salmonella typhimurium* infection on sheep. 1981. J.A. Naser
- OP.3211/19/2/6: Pathological, virological and haematological investigations on calves infected with Wesselsbron disease virus. 1983. J.A.W. Coetzer
- OP.3211/19/2/7: Pathological investigations: evaluation of methods for *post mortem* recognition of toxic injury in ovine myocardium. 1984. S.J. Newsholme
- OP.3211/19/2/8: Pathological investigation: toxicology, clinical pathology and pathology of *Cestrum laevigatum* poisoning in sheep and cattle. 1985. J.J. van der Lugt
- OP.3211/19/3/1: Pathological and ophthalmological investigations on vervet monkeys infected with Rift Valley fever virus. 1983. J.A.W. Coetzer

### Food hygiene/Voedselhigiëne

#### ANIMAL FOODS/DIERLIKE VOEDSELS

##### PATHOLOGY/PATOLOGIE

- OP.3221/19/1/1: Animal foods: diagnosis of mastitis as a herd problem. 1981. W.H. Giesecke
- OP.3221/19/1/2: Animal foods: microscopical investigation of the teat tip and canal at different stages of udder development. 1982. I. Clayden
- OP.3221/19/1/3: Animal foods: lacteal levels of glucose and frequencies of subclinical mastitis and other udder conditions. 1981. W.H. Giesecke
- OP.3221/19/1/5: Animal foods: the effect of teat dipping on subclinical udder conditions in dairy cows milked by a machine. 1982. W.H. Giesecke
- OP.3221/19/1/6: Animal foods: a study of marker dyes and antibiotic levels in milk after udder treatment against mastitis. 1982. I. Clayden
- OP.3221/19/1/7: Animal foods: normal bacterial flora on bovine udders as affected by age, breed and season. 1979. Anette M. Durand

## Registered projects/Geregistreerde projekte

- OP.3221/19/1/8: Animal foods: metabolic activity of somatic cells in blood and milk of mastitic cows. 1982. Z.E. Kowalski
- OP.3221/19/1/9: Animal foods: interlaboratory standardisation of somatic cell counts in cows' milk in the RSA. 1983. W.H. Giesecke
- OP.3221/19/1/10: Animal foods: the development of the methodology for an investigation of primary prostaglandins and thromboxanes in the normal and pathological udder secretion. 1985. Z.E. Kowalski
- OP.3221/19/1/11: Animal foods: a methodological investigation of the lipoxygenase products of arachidonic acid in normal and pathological udder secretions and tissue homogenates. 1985. Z.E. Kowalski
- OP.3221/19/2/1: Animal foods: tissue reactions and antibiotic residues in slaughter stock injected with long-acting antibiotics. 1981. I. Clayden
- OP.3221/19/3/1: Animal foods: potentially pathogenic micro-elements in animal feeds. 1981. K. Ogonowski
- OP.3221/19/3/2: Animal foods: antibiograms of *Salmonella* spp. from commercial animal feeds. 1982. Anette M. Durand
- OP.3221/19/3/3: Animal foods: antibiograms of *Escherichia coli* from commercial animal feeds. 1982. Anette M. Durand

## TECHNOLOGY/TEGNOLOGIE

- OP.3221/52/1/1: Animal foods: proteolytic preparation of meat for culturing of toxin production by *Clostridium* spp. 1982. Anette M. Durand
- OP.3221/52/2/1: Animal foods: differentiation of the species origin of different meat types. 1983. W.H. Giesecke

## Toxicological investigations/Toksikologiese ondersoeke

### TOXIC SUBSTANCES/TOKSIESE STOWWE

#### TOXICOLOGY/TOKSIKOLOGIE

- OP.3231/18/1/1: Diagnostics of poisoning of animals by toxic substances. 1981. T.S. Kellerman
- OP.3231/18/2/1: The role of fungi, plants and toxic substances in the aetiology and pathogenesis of photosensitivity. 1971. T.S. Kellerman
- OP.3231/18/2/3: The efficacy of acetamide in the prevention and treatment of experimentally induced gifblaar poisoning in sheep. 1984. T.S. Kellerman
- OP.3231/18/2/4: Evaluation of the efficacy of medical and industrial activated charcoals in the prophylaxis and treatment of plant poisonings and mycotoxicoses. 1984. T.S. Kellerman
- OP.3231/18/2/5: Salinomycin poisoning in horses. 1985. P.W. Nel

## Internal parasite investigations/Interne-parasietondersoeke

### HELMINTHS/HELMINTE

#### TAXONOMY/TAKSONOMIE

- OP.3241/01/1/1: Identification of helminths and investigation of definite host ranges. 1983. E.L. Visser
- OP.3241/01/1/2: The taxonomy and incidence of helminths of the Cape hyrax (*Procavia capensis*). 1983. E.L. Visser



## PESTS/PLAE

- OP.3241/20/1/1: Helminths: diagnosis of unknown internal parasite phenomena. 1981. J.A. van Wyk
- OP.3241/20/2/1: Helminths: immunology and serology of cysticercosis of cattle and pigs. 1970. E.L. Visser
- OP.3241/20/2/3: Helminths: immunity of sheep to the larval stage of *Taenia multiceps*. 1979. A.J.M. Verster
- OP.3241/20/2/4: Helminths: infestation of goats with the larval stage of *Taenia multiceps*. 1971. A.J.M. Verster
- OP.3241/20/2/5: Helminths: epidemiology of tapeworms of ruminants. 1982. E.L. Visser
- OP.3241/20/2/6: Helminths: incidence and treatment of *Stilesia globipunctata* infestation in South Africa. 1983. E.L. Visser
- OP.3241/20/3/1: Helminths: reinfestation of cattle with bilharzia. 1969. J.A. van Wyk
- OP.3241/20/3/2: Helminths: influence of temperature on the development of the larval stages of *Fasciola* spp. 1979. R.M.R. Alves
- OP.3241/20/3/3: Helminths: development of *Fasciola* spp. of cattle and sheep in various definitive hosts. 1978. R.M.R. Alves
- OP.3241/20/3/4: Helminths: pathological physiology of *Schistosoma matthei* infestation of sheep and cattle. 1969. J.A. van Wyk
- OP.3241/20/3/5: Helminths: epidemiology of paramphistomiasis. 1981. J.A. van Wyk
- OP.3241/20/4/1: Helminths: economic importance of parafilariosis of cattle. 1977. I.H. Carmichael

## CHEMICAL CONTROL/CHEMIESE BEHEER

- OP.3241/21/1/1: Chemical control of helminths with special reference to resistance. 1982. J.A. van Wyk

## TECHNOLOGY/TEGNOLOGIE

- OP.3241/52/1/1: Helminths: long-term storage of pure strains of helminths. 1973. J.A. van Wyk
- OP.3241/52/1/2: Recovery of helminths and/or their ova from animals. 1976. J.A. van Wyk
- OP.3241/52/1/3: Helminths: *ante-mortem* determination of worm loads in animals. 1985. J.A. van Wyk

## Reproduction investigations/Reproduksie-ondersoeke

### INFERTILITY/ONVRUGBAARHEID

#### PATHOLOGY/PATOLOGIE

- OP.3251/19/1/1: Diagnostics of infertility and abortion in animals. 1973. Lesley A. te Brugge
- OP.3251/19/1/2: Serodiagnostics of infertility, abortion and other diseases. 1981. S. Herr
- OP.3251/19/2/1: Infertility: reduced dose vaccination of adult cattle with *Brucella abortus* strain 19. 1981. S. Herr
- OP.3251/19/2/2: Infertility: immunity to trichomoniasis in cattle. 1981. S. Herr
- OP.3251/19/2/3: Infertility: ulcerative dermatosis in sheep. 1981. C.J.V. Trichard
- OP.3251/19/2/5: Infertility: bacterial infections of the genitalia of sheep. 1981. B.C. Jansen

Entomological investigations/Entomologiese ondersoeke

EXTERNAL PARASITES/EKSTERNE PARASIEETE

ENTOMOLOGY/ENTOMOLOGIE

- OP.3261/14/1/1: External parasites: identification and systematics of insects of veterinary importance. 1981. E.M. Nevill

ACAROLOGY/AKAROLOGIE

- OP.3261/15/1/1: External parasites: identification and systematics of ticks and mites of veterinary importance. 1981. J.B. Walker
- OP.3261/15/1/2: External parasites: systematics of the genus *Rhipicephalus*. 1973. J.B. Walker

PATHOLOGY/PATOLOGIE

- OP.3261/19/1/1: External parasites: *Cowdria ruminantium* in *Amblyomma hebraeum*. 1977. J.D. Bezuidenhout
- OP.3261/19/1/2: External parasites: multiplication of arboviruses in *Culicoides* spp. 1973. E.M. Nevill
- OP.3261/19/1/3: External parasites: aetiology of sweating sickness. 1971. J.D. Bezuidenhout
- OP.3261/19/1/5: External parasites: the influence of weaning on serum congenitine levels of calves, as well as on their susceptibility to heartwater. 1983. J.L. du Plessis
- OP.3261/19/1/6: External parasites: the influence of tick control on the epidemiology of heartwater. 1983. J.L. du Plessis
- OP.3261/19/1/7: External parasites: serological and immunological methods for heartwater research. 1983. J.D. Bezuidenhout
- OP.3261/19/1/8: External parasites: a biochemical study of the tissues of *Rhipicephalus evertsi*, *Hyalomma* spp., *Exodes rubicundus*, *Boophilus* spp. *Ornithodoros savignyi* with special reference to their toxins. 1984. J.D. Bezuidenhout
- OP.3261/19/1/9: External parasites: determination of the tick load that will ensure enzootic stability with regard to heartwater. 1984. J.L. du Plessis
- OP.3261/19/1/10: External parasites: the epidemiology of Karoo paralysis. 1985. J.D. Bezuidenhout
- OP.3261/19/1/11: External parasites: the *in vitro* cultivation of *Cowdria ruminantium*. 1985. C.L. Paterson

PESTS/PLAE

- OP.3261/20/1/2: External parasites: transmission of *Parafilaria bovicola* by the *Muscidae*. 1972. E.M. Nevill
- OP.3261/20/1/3: External parasites: biology and control of *Simulium* spp. in South Africa. 1968. L.C. Jordaan
- OP.3261/20/1/4: External parasites: resistance of ticks to acaricides. 1976. A.M. Spickett
- OP.3261/20/1/5: External parasites: tick resistance in indigenous and European cattle breeds. 1982. A.M. Spickett
- OP.3261/20/1/6: External parasites: the effects of host immunity of Brahman and Hereford cattle breeds on the dynamics of tick populations in a mixed sourveld environment. 1984. A.M. Spickett
- OP.3261/20/1/7: External parasites: hosts of *Amblyomma hebraeum* and their importance in the epidemiology of heartwater. 1985. I.G. Horak

**Virus investigations/Virusondersoeke**

**VIRUSES/VIRUSSE**

**PATHOLOGY/PATOLOGIE**

- OP.3271/19/1/1: Diagnostics of virus diseases of animals. 1981. B.J. Erasmus
- OP.3271/19/2/3: Growth attenuation of African horse sickness viruses in tissue culture. 1968. B.J. Erasmus
- OP.3271/19/2/5: Modification of bluetongue virus in tissue culture. 1970. K.E. Weiss
- OP.3271/19/2/6: Characterisation of newer orbiviruses. 1973. B.J. Erasmus
- OP.3271/19/2/7: Flavivirus infection of sheep and cattle. 1981. B.J.H. Barnard
- OP.3271/19/2/8: Survey of bluetongue and other viruses in *Culicoides* spp. 1979. B.J. Erasmus
- OP.3271/19/2/9: Viruses: the epidemiology of bovine malignant catarrh. 1983. B.J.H. Barnard
- OP.3271/19/2/10: Viruses: pathogenicity and tick transmission of Crimean Congo haemorrhagic fever in cattle and sheep. 1984. B.J. Erasmus

**Highly contagious diseases/Hoogsaansteeklike siektes**

**HIGHLY CONTAGIOUS VIRUSES/HOOGSAANSTEEKLIKE VIRUSSE**

**PATHOLOGY/PATOLOGIE**

- OP.3281/19/1/1: Diagnostics of highly contagious virus diseases of animals. 1980. G.R. Thomson
- OP.3281/19/1/2: Highly contagious viruses: the development of ELISA techniques for the detection of foot-and-mouth disease (FMD) and swine vesicular disease (VSD) viruses and antibodies directed against them. 1985. J.J. Esterhuyzen
- OP.3281/19/2/1: Highly contagious viruses: epidemiology of African swine fever in free-living hosts. 1978. G.R. Thomson
- OP.3281/19/2/2: Highly contagious viruses: pathogenicity and antigenic heterogeneity of naturally occurring African swine fever viruses. 1979. G.R. Thomson
- OP.3281/19/2/3: Highly contagious viruses: the role of wild cloven-hoofed animals in the epidemiology of foot-and-mouth disease. 1981. G.R. Thomson
- OP.3281/19/2/4: Highly contagious viruses: assessment of foot-and-mouth disease vaccines. 1983. A. Pini
- OP.3281/19/2/5: Highly contagious viruses: investigation on the excretion of SAT types of foot-and-mouth disease (FMD) virus from experimentally infected cattle. 1984. M.D. Gainaru

**Poultry and fish diseases/Pluimvee- en vissiektes**

**POULTRY/PLUIMVEE**

**PATHOLOGY/PATOLOGIE**

- OP.3291/19/1/1: Diagnostics of disease conditions of poultry. 1981. E.J. Marais
- OP.3291/19/2/2: Altitude disease ascites of broilers. 1985. F.W. Huchzermeyer
- OP.3291/19/2/3: Turkey malaria. 1985. F.W. Huchzermeyer



FISH/VIS

PATHOLOGY/PATOLOGIE

OP.3292/19/1/1: Diagnostics of disease conditions of fish. 1981. F.W. Huchzermeyer

**Bacterial investigations/Bakteriese ondersoeke**

BACTERIA/BAKTERIEë

PATHOLOGY/PATOLOGIE

OP.32101/19/1/1: Diagnostics of bacterial diseases of animals. 1981. Marijke M. Henton

OP.32101/19/2/4: Bacteria: improvement of *E. coli* vaccines. 1982. P. Oberem

OP.32101/19/2/6: Bacteria: development of an effective *Clostridium septicum* vaccine. 1983. M.J. de Bruyn

OP.32101/19 2/7: Investigation of various culture media for optimal growth of *Camphylobacter fetus* for vaccine production. 1984. M.L. Swanepoel

**Protozoal investigations/Protosoa-ondersoeke**

PROTOZOA/PROTOSOA

PATHOLOGY/PATOLOGIE

OP.32111/19/1/1: Diagnostics of protozoal and rickettsial diseases of animals. 1981. C.D. van Aardt

OP.32111/19/2/1: Protozoa: quality, safety and efficacy of Onderstepoort vaccines against bovine babesiosis. 1981. F.T. Potgieter

OP.32111/19/2/2: Protozoa: epidemiology of *Besnoitia besnoitii* infection in cattle. 1981. F.T. Potgieter

OP.32111/19/2/3: Protozoa: identity, distribution and transmission of *Theileria* spp. in South Africa. 1977. J.A. Roos

OP.32111/19/2/6: Protozoa: *in vitro* cultivation of *Babesia* spp. with special reference to *Babesia bovis*. 1984. T.E. Mason

OP.32111/19/2/7: Protozoa: a study of babesiosis in horses. 1984. D.T. de Waal

OP.32111/19 3 1: Protozoa: the quality, safety and efficacy of Onderstepoort anaplasmosis vaccines. 1981. F.T. Potgieter

OP.32111, 19 3 2: Protozoa: transmission of *Anaplasma marginale* by ticks and biting insects. 1977. F.T. Potgieter

**Molecular biological investigations/Molekulêre biologiese ondersoeke**

MACROMOLECULES/MAKROMOLEKULE

VIROLOGY/VIROLOGIE

OP.32121/12/1/3: Macromolecules: serological studies of jaagsiekte retrovirus. 1982. M.S. Meyer

OP.32121/12 1 4: Macromolecules: cloning of jaagsiekte virus through genetic manipulation. 1982. E.M. de Villiers

OP.32121 12 1 5: Macromolecules: the development of immunocytochemical techniques to identify various viral antigens in tissue sections, as well as cell cultures associated with jaagsiekte. 1984. A. Payne

OP.32121/12/1/6: Production of monoclonal antibodies against jaagsiekte retrovirus antigens. 1985. D.F. York

PROTOZOOLOGY/PROTOSOÖLOGIE

- OP.32121/13/1/1: The construction and partial characterisation of genomic libraries of *Babesia* and *Anaplasma* DNA. 1985. R.E. Ambrosio

**Biochemical investigations/Biochemiese ondersoeke**

BIOCHEMICAL INVESTIGATIONS/BIOCHEMIESE ONDERSOEKE

VIROLOGY/VIROLOGIE

- OP.32131/12/1/1: Biochemical investigations: *in vitro* activation of transcriptase activity with bluetongue virus. 1979. Alberdina A. van Dijk
- OP.32131/12/1/2: Biochemical investigations of the antigens and antibodies involved in the bluetongue virus immune reaction. 1980. N.T. van der Walt
- OP.32131/12/1/3: Biochemical investigations of the structural proteins of bluetongue virus. 1981. M. Cloete
- OP.32131/12/1/4: Biochemical investigations of non-structural proteins of bluetongue virus. 1981. A.R. Bauskin
- OP.32131/12/1/5: Biochemical investigations of the synthesis of bluetongue virus proteins in cell-free systems. 1981. Alberdina A. van Dijk
- OP.32131/12/1/6: Biochemical investigations: cloning of the bluetongue virus genome segments. 1984. H. Huismans

**Chemical pathology and poison chemistry/Chemiese patologie en gifstofchemie**

POISONS/GIFSTOWWE

TOXICOLOGY/TOKSIKOLOGIE

- OP.32141/18/1/1: Poisons of and poisoning by cardiac glycosides from plants of the family Crassulaceae. 1981. L.A.P. Anderson
- OP.32141/18/1/2: Poisons of and poisoning caused by *Cynanchum* species. 1981. G.L. Erasmus
- OP.32141/18/1/3: Poisons of and poisoning caused by *Sarcostemma viminalis*. 1984. L.A.P. Anderson
- OP.32141/18/1/4: Poisons of and poisoning caused by *Ornithogalum thyrsoides*. 1983. J. de V. du Toit
- OP.32141/18/2/1: Poisons of and poisoning caused by tremorgenic mycotoxins of *Aspergillus clavatus*. 1975. L.A.P. Anderson

## AGRICULTURAL RESOURCE UTILISATION LANDBOUHULPBRONBENUTTING

### RESOURCE RESEARCH/HULPBRONNAVORSING

#### Primary resources/Primêre hulpbronne

##### SOIL/GROND

##### SOIL SCIENCE/GRONDKUNDE

- GB.5111/32/1/3: Soil fertility - a basis according to which soils can be grouped. 1975. A.J. van der Merwe
- GB.5111/32/2/1: The isolation, identification, quantitative determination and chemical reactions of growth stimulating and inhibiting organic compounds in soil and crop residues of summer and small grains. 1980. P. de L. R. Swartz
- GB.5111/32/2/3: The effect of nitrite, benzoic and cinnamic acid mixtures on the stimulation or inhibition of micro-organism populations in soil. 1981. I.R. de Wet
- GB.5111/32/3/1: The distribution and properties of liming materials and waste products with reference to suitability for amelioration of RSA soils. 1979. H.C.H. Hahne
- GB.5111/32/3/2: Silicon-phosphorus-sesquioxide relationships with a view to amelioration of acid soils with silicate. 1979. T.W. Payne
- GB.5111/32/3/4: Ad hoc mineralogical analyses and investigations. 1982. S.P. Terblanche
- GB.5111/32/3/5: Morphological and mineralo-chemical studies of some South African podzols and podzolised soils. 1982. L.C. Hawker
- GB.5111/32/3/6: Qualitative and quantitative IR-studies of N containing compounds in fertilisers generally available in a large area. 1984. J. Zeilhofer
- GB.5111/32/3/7: The dynamics of neutralising agents of porous inert media and soil in a larger area. 1985. A.J. van der Merwe
- GB.5111/32/3/8: The chemical nature of soil acidification. 1982. A.J. van der Merwe
- GB.5111/32/5/1: The quantitative characterisation of a porous medium, e.g. soil. 1981. D.A. Russell
- GB.5111/32/5/2: Quantitative characterisation of the physical genesis of soil particulate material. 1981. D.A. Russell
- GB.5111/32/6/1: Detailed description of the soils of RSA (first approximation). 1983. C.N. MacVicar
- H.5111/32/1/1: The influence of liming on the acidic properties of dominant soils in the Highveld Region with maize as an indicator plant. 1979. D.J. Beukes
- H.5111/32/1/2: Micro-element status of Hutton, Clovelly and Avalon soils in the Highveld Region at different degrees of soil acidity. 1981. D.J. Beukes
- H.5111/32/3/2: The soil moisture holding capacity of soils in the Highveld Region. 1981. A.M. Hattingh
- H.5111/32/3/3: Influence of crop residue on the moisture content and other physical properties of soils in the Highveld Region. 1982. A.M. Hattingh
- H.5111/32/4/1: The effects of different stubble mulch practices on the soil water and other physical properties of a Rensburg series. 1984. D.J. Beukes



## Registered projects/Geregistreerde projekte

- H.5111/32/5/1: The effects of different levels of phosphorus and nitrogen on crop yield on a Rensburg soil series under stubble mulch tillage in the Highveld Region. 1984. D.J. Beukes
- H.5111/32/6/1: An investigation into the macro-element status of soils in different land types in the Highveld Region. 1984. R.W. Bruce
- T.5111/32/1/1: Soil: co-operative fertilisation and liming field trials in collaboration with the extension service in the Transvaal Region. 1970. J.T. Truter
- T.5111/32/1/2: Soil: the effect of phosphate fixation and aluminium toxicity on maize production. 1971. J.T. Truter
- T.5111/32/1/3: Soil: effect of rock phosphate and double supers on optimal maize production. 1980. G.J. du Toit
- T.5111/32/1/4: Soil: amelioration of soil acidity for optimum maize production. 1980. G.T. du Toit
- T.5111/32/1/5: Soil: nitrogen phosphorus and potassium fertilisation on different soils for maize production. 1980. G.J. du Toit
- T.5111/32/1/6: Soil: band placing *versus* plough-in of phosphorus for maize production. 1980. G.J. du Toit
- T.5111/32/1/7: Soil: potassium fertilisation for maize production on soils differing in levels of potassium. 1980. G.J. du Toit
- V.5111/32/1/1: Soil: the availability of potassium in a Mangano soil series to lucerne under irrigation at Sandvet. 1978. P.J. Snyman
- V.5111/32/1/2: Soil: phosphorus status of and supply to different soil series in the Free State Region. 1979. P.J. Snyman
- V.5111/32/1/5: Soil: a comparison of different nitrogen sources for wheat on a Hutton soil at Vaalharts. 1983. P.J. Snyman
- V.5111/32/1/6: Soil: the effect of fertilisers on the sulphur status in a Hutton soil at Glen. 1984. A. van Schalkwyk
- V.5111/32/1/7: Soil: the availability of phosphorus in a Mangano soil for dryland wheat at Sandvet. 1985. P.J. Snyman
- V.5111/32/1/8: Soil: the availability of phosphorus in a Hutton soil for dryland wheat at Glen. 1984. P.J. Snyman
- V.5111/32/1/9: Soil: the effect of fertiliser on the sulphur status of a Dundee soil at Upington. 1985. A. van Schalkwyk
- W.5111/32/1/1: The macro-element status of soils of the winter rain cropping area. 1968. G.R. Thompson
- W.5111/32/2/1: Soil: a study of the correlations between chemically extractable phosphorus and phosphorus absorption by different crops in the Winter Rainfall Region. 1974. G.R. Thompson
- W.5111/32/2/2: Soil: the effect of potassium fertilising levels on the growth and yield of wheat in the winter rain cropping area. 1977. C.P. de L. Beyers
- W.5111/32/2/3: The effect of gypsum on the yield of winter cereals on shallow, saline soils of the winter rain cropping area. 1980. C.P. de L. Beyers
- W.5111/32/2/4: A comparison of diammonium EDTA with alternative extractants and procedures for the determination of trace elements in soils of the winter rain cropping area. 1981. T. Hammond
- W.5111/32/3/1: The preparation of monoliths of representative soil types in the winter rain cropping area. 1976. G.R.C. Cooper
- W.5111/32/4/1: The effect of soil type on the interaction between N and P in the Winter Rainfall Region with small grain types as indicator plants. 1985. G.R. Thompson

## WATER

### WATER REQUIREMENTS/WATERBEHOEFTE

- GB.5112/31/1/3: Evaluation and improvement of irrigation management in the Loskop irrigation area. 1980. A. Streutker
- GB.5112/31/1/4: Flood irrigation design criteria establishment for major South African soils. 1981. D.A. Russell
- GB.5112/31/2/1: Determination of water requirements of certain annual crops at Roodeplaat as a function of soil, plant and atmospheric factors. 1976. G.C. Green

### SOIL SCIENCE/GRONDKUNDE

- GB.5112/32/1/1: Reclamation of salt and sodic soils: influence of exchangeable sodium, exchange equilibria and electrolyte concentration of irrigation water. 1972. H.J.C. Smith
- GB.5112/32/1/3: Methods of ameliorating the acid mine water problem in South Africa. 1979. J.G. Thompson
- GB.5112/32/1/4: The effectiveness of soils in reducing water pollution when effluents are disposed of on land. 1979. H.M. du Plessis
- GB.5112/32/1/5: The beneficial utilisation of sludge wastes from water treatment processes on certain South African soils through crop production. 1982. L. Champion

### MODELLING/MODELLERING

- GB.5112/42/1/1: Modelling of return flow of irrigation water - the Fish River and Sundays River catchment and irrigation areas. 1974. H.M. du Plessis
- GB.5112/42/1/2: Modelling of return flow of irrigation water - the Breë River between Brandvlei Dam and Robertson. 1979. J.L. Hutson
- GB.5112/42/1/3: Development and application of models for predicting water and salt movement in a radio active waste disposal in the Karoo and arid areas. 1983. J.L. Hutson
- GB.5112/42/1/4: Simulation of the water, salt, plant nutrient regime in cropped soils in a large area. 1983. J.L. Hutson

## CLIMATE/KLIMAAT

### WATER REQUIREMENTS/WATERBEHOEFTE

- GB.5113/31/1/1: The value of climatic formulae (temperature) to estimate potential evapotranspiration in the summer rainfall area. 1981. B. St. E. Clemence

### METEOROLOGY/WEERKUNDE

- GB.5113/33/1/1: Acquisition and processing of climatic data of the RSA. 1978. A.V. Kotze
- GB.5113/33/1/2: Climate: drought investigation in order to provide an index for drought determination from meteorological data. 1979. J. Booyesen
- GB.5113/33/1/3: Agroclimate of subtropical crops. 1978. A.L. du Pisani
- GB.5113/33/1/4: Climate: the determination and classification of the moisture supply potential of natural rainfall. 1978. A.L. du Pisani
- GB.5113/33/1/6: Climate: mapping of the mean monthly rainfall in the Winter Rainfall Region. 1979. G.K. Viljoen
- GB.5113/33/1/8: Climate: wind surveys in citrus production areas. 1978. C.P. Welgemoed

## Registered projects/Geregistreerde projekte

- GB.5113/33/1/9:** Climate: total radiation in the Winter Rainfall Region. 1980. G.W. Matthee
- GB.5113/33/1/10:** Delineation of homogeneous climatic areas for maize production in the summer rain cropping areas. 1983. F.G.L. Koch
- GB.5113/33/1/11:** Climate: the determination of the last frost dates along the Orange River with reference to the cultivation of wheat. 1985. S.L.M. Fleischer
- GB.5113/33/1/12:** Climate: the estimating of mean hourly temperature from daily maximum and minimum temperatures in the winter rain cropping area. 1985. J.M. Hoon
- GB.5113/33/2/1:** Climate: correlation between weather factors and picking dates of apples. 1978. G.W. Matthee
- GB.5113/33/2/2:** Inter-relationships between macroclimate and maize growth. 1978. J.F. Erasmus
- GB.5113/33/2/3:** The influence of climate on cotton. 1978. G.W.E.A. Garlipp
- GB.5113/33/2/5:** The influence of climate on the occurrence of internal breakdown in plums in the winter rain cropping area. 1983. G.W. Matthee
- GB.5113/33/2/6:** The influence of climate on the occurrence of premature ripening of Bon Chretien pears in the winter rain cropping area. 1983. J.M. Hoon
- GB.5113/33/2/7:** The dispersal and deposition of leaf and stem rust spores on wheat by means of upper-air winds and rainfall over southern Africa. 1985. S.L.M. Fleischer
- GB.5113/33/2/8:** Determination of stress in maize as a result of soil-plant-atmosphere conductance with special reference to surface temperature and stomatal resistance. 1985. W.J. van den Berg
- GB.5113/33/3/1:** Microclimatic study of the Theewaterskloof Dam terrain. 1978. G.K. Viljoen
- GB.5113/33/3/3:** Climate: high palmette systems as windbreaks. 1978. G.K. Viljoen
- GB.5113/33/3/4:** Climate: the influence of wind and windbreaks on apple production. 1981. R. Eicker
- GB.5113/33/4/1:** In-time identification and prediction of unfavourable weather conditions for the Angora goat industry (climate). 1980. J. Booysen

## Energy/Energie

### FUELS/BRANDSTOWWE

#### ENGINEERING/INGENIEURSWESE

- LI.5121/51/1/1:** Research on and development of plant oils and alcohols for engines in agriculture. 1979. F.J.C. Hugo

## Surveys and demarcation/Opnames en afbakening

### SOIL SURVEYS/GRONDOPNAMES

#### SOIL SCIENCE/GRONDKUNDE

- D.5131/32/1/1:** Soil surveys in the Dohne-Bolo area. 1979. M.D. Hartmann
- GB.5131/32/1/1:** Land type survey (terrain form, soils, climate) of the Highveld Region. 1979. R.W. Bruce
- GB.5131/32/1/2:** Land type survey (terrain form, soils, climate) of the Eastern Cape Region. 1973. B.H.A. Schloms



## Registered projects/Geregistreeerde projekte

- GB.5131/32/1/3: Land type survey (terrain form, soils, climate) of the OFS Region. 1973. J.F. Eloff
- GB.5131/32/1/4: Land type survey (terrain form, soils, climate) of Natal Region. 1973. D.P. Turner
- GB.5131/32/1/5: Land type survey (terrain form, soils, climate) of Transvaal Region. 1973. J.L. Schoeman
- GB.5131/32/1/6: Land type survey (terrain form, soils, climate) of the Winter Rainfall Region. 1973. B.H.A. Schloms
- GB.5131/32/1/7: Land type survey (terrain form, soils, climate) of the Karoo Region. 1973. B.H.A. Schloms
- GB.5131/32/2/1: Standard 1:50 000 soil survey of the Pretoria-Witwatersrand-Vereeniging complex. 1973. T.U. Yager
- GB.5131/32/2/2: Standard 1:50 000 soil survey of the Cape Town-Moorreesburg-Worcester complex. 1975. B.H.A. Schloms
- GB.5131/32/3/1: Soil surveys and investigations for irrigation purposes. 1973. J.F. Eloff
- GB.5131/32/3/2: Soil surveys and investigations for purposes other than irrigation. 1974. F. Ellis
- N.5131/32/1/1: Farm soil surveys in Natal Region. 1980. A.D. Manson

## VELD SURVEYS/VELDOPNAMES

### SITUATION ANALYSIS/SITUASIEBEPALING

- D.5132/35/1/1: The determination of the veld condition through veld surveys in the Dohne-Bolo area. 1980. L.R. Hall

## WATER SURVEYS/WATEROPNAMES

### SITUATION ANALYSIS/SITUASIEBEPALING

- D.5133/35/1/1: Water surveys in the Dohne-Bolo area. 1980. R.F.M. Childs

### POTENTIAL STUDIES/POTENSIAALSTUDIES

- H.5134/36/1/1: Demarcation of fairly homogeneous farming areas in the Highveld Region. 1981. J.J. Scheepers
- H.5134/36/1/2: The description of production possibilities of natural resources within 57 RHF's in the Highveld Region. 1980. J.J. Scheepers
- H.5134/36/1/3: The provision of production norms and techniques for agricultural commodities for various resource situations within RHF's of the Highveld Region. 1981. J.J. Scheepers
- H.5134/36/1/4: The description of production possibilities of natural resources per magisterial district according to RHF subdivisions in the Highveld Region. 1983. B.P. Ludick
- H.5134/36/1/5: The classification of natural resources into ecotopes within 57 RHF's in the Highveld Region. 1984. B.P. Ludick

## FAIRLY HOMOGENEOUS AGRICULTURAL AREAS/REDELIK HOMOGENE BOERDERYGEBIEDE

### ECOLOGY/EKOLOGIE

- K.5134/27/1/1: RHFA: a plant ecological study of the Karoo Region in terms of land types. 1983. M. Vorster

## Registered projects/Geregistreeerde projekte

|                 |                                                                                                              |
|-----------------|--------------------------------------------------------------------------------------------------------------|
| K.5134/27/2/1:  | RHFA: classification of irrigation areas in the Extension Ward Cradock. 1980. P.S. van Heerden               |
| K.5134/27/2/2:  | RHFA: classification of irrigation areas in the Extension Ward Somerset East. 1985. P.S. van Heerden         |
| K.5134/27/3/1:  | Demarcation of fairly homogeneous agricultural areas in the Extension Ward Cradock. 1983. A.J. Siepker       |
| K.5134/27/3/2:  | Demarcation of fairly homogeneous agricultural areas in the Extension Ward Graaff-Reinet. 1983. A.J. Siepker |
| K.5134/27/3/3:  | Demarcation of fairly homogeneous agricultural areas in the Extension Ward Jansenville. 1983. A.J. Siepker   |
| K.5134/27/3/4:  | Demarcation of fairly homogeneous agricultural areas in the Extension Ward Somerset East. 1983. A.J. Siepker |
| K.5134/27/3/5:  | Demarcation of fairly homogeneous agricultural areas in the Burgersdorp Extension Ward. 1983. A.J. Siepker   |
| K.5134/27/3/6:  | Demarcation of fairly homogeneous agricultural areas in the Colesberg Extension Ward. 1983. A.J. Siepker     |
| K.5134/27/3/7:  | Demarcation of fairly homogeneous agricultural areas in the De Aar Extension Ward. 1983. A.J. Siepker        |
| K.5134/27/3/8:  | Demarcation of fairly homogeneous agricultural areas in the Middelburg Extension Ward. 1983. A.J. Siepker    |
| K.5134/27/3/9:  | Demarcation of fairly homogeneous agricultural areas in the Calvinia Extension Ward. 1983. A.J. Siepker      |
| K.5134/27/3/10: | Demarcation of fairly homogeneous agricultural areas in the Carnarvon Extension Ward. 1983. A.J. Siepker     |
| K.5134/27/3/11: | Demarcation of fairly homogeneous agricultural areas in the Kenhardt Extension Ward. 1983. A.J. Siepker      |
| K.5134/27/3/12: | Demarcation of fairly homogeneous agricultural areas in the Prieska Extension Ward. 1983. A.J. Siepker       |
| K.5134/27/3/13: | Demarcation of fairly homogeneous agricultural areas in the Beaufort West Extension Ward. 1983. A.J. Siepker |
| K.5134/27/3/14: | Demarcation of fairly homogeneous agricultural areas in the Fraserburg Extension Ward. 1983. A.J. Siepker    |
| K.5134/27/3/15: | Demarcation of fairly homogeneous agricultural areas in the Laingsburg Extension Ward. 1983. A.J. Siepker    |
| K.5134/27/3/16: | Demarcation of fairly homogeneous agricultural areas in the Victoria West Extension Ward. 1983. A.J. Siepker |

## LAND USE/GRONDGEBRUIK

### SITUATION ANALYSIS/SITUASIEBEPALING

|                |                                                                  |
|----------------|------------------------------------------------------------------|
| N.5135/35/1/1: | Present land use survey of Natal (Agriquest). 1979. J.B.M. Smith |
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## OTHER SURVEYS/ANDER OPNAMES

### SITUATION ANALYSIS/SITUASIEBEPALING

|                |                                                                                                    |
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| D.5136/35/1/1: | A situation survey of present farming practices in the Stutterheim Extension Ward. 1983. P.G. King |
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## Registered projects/Geregistreeerde projekte

- HK.5136/35/1/1: An investigation into woolled sheep farming in the Republic of South Africa. 1982. R.E.D. Bradfield
- HK.5136/35/2/1: Other surveys: an investigation into factors inhibiting the adoption of recommended veld management practices in the recognised grazing areas of the RSA. 1984. C.H. de Klerk
- HK.5136/35/3/1: Other surveys: an investigation into the adoption of recommended agricultural practices in the summer rain cropping areas owing to the provision of co-ordinated information to farmers. 1985. C.H. de Klerk
- N.5136/35/1/1: Changes in the extent of agriculturally eroded areas in Natal since 1950 and the relationship of such changes with land use modification and an evaluation of erosion status and sediment delivery in Natal. 1983. W.B. Russell

## POTENTIAL STUDIES/POTENSIAALSTUDIES

- HK.5136/36/1/1: Other surveys: agricultural development plan for Rehoboth Gebiet. 1982. C.H. de Klerk

## EXTENSION SCIENCE/VOORLIGTINGKUNDE

- HK.5136/40/1/1: Other surveys: an investigation into the efficiency of study groups in Transvaal. 1984. C.H. de Waal

## Irrigation development/Besproeiingsontwikkeling

### IRRIGATION PLANNING/BESPROEIINGSBEPLANNING

#### EVALUATION/EVALUASIE

- GB.5141/37/1/1: Evaluation of areas for irrigation development and farm layout on State Schemes. 1979. J.A. Stofberg
- GB.5141/37/1/2: Evaluation of existing irrigation schemes. 1982. J.A. Stofberg

## RESOURCE UTILISATION RESEARCH (CROPS)/HULPBRON-BENUTTINGSNAVORSING (GEWASSE)

### Field crops/Landgewasse

#### SUMMER GRAIN/SOMERGRAAN

#### PHYSIOLOGY/FISIOLOGIE

- N.5211/03/1/1: Aluminium tolerance of maize cultivars in Natal. 1982. R.J. Bennet

#### NUTRITION/VOEDING

- D.5211/05/1/1: Summer grain: NPK nutrition of maize at Dohne. 1978. R.S. Marr
- D.5211/05/1/2: Summer grain: NPK nutrition of maize at Sternberg. 1978. R.S. Marr
- D.5211/05/1/3: Summer grain: NP nutrition of maize at Sternberg. 1980. R.S. Marr
- D.5211/05/1/4: Summer grain: NP nutrition of maize at Ugie. 1980. R.S. Marr

#### PESTS/PLAE

- T.5211/20/1/1: Summer grain: survey of fungus-growing termites on agronomic crops. 1977. H.H. Gouse



## CROP SCIENCE/GEWASKUNDE

- D.5211/30/1/1: Summer grain: maize planting dates at Dairyland, Bathurst. 1979. R.S. Marr
- D.5211/30/1/2: Summer grain: maize planting dates at Redlands, Bathurst. 1979. R.S. Marr
- D.5211/30/1/3: Summer grain: maize planting dates at Dohne. 1978. R.S. Marr
- H.5211/30/1/1: Summer grain: verification of production techniques and yield norms for grain sorghum on an Arcadia soil form in the Highveld Region. 1985. G.H. Koen
- V.5211/30/1/1: Summer grain: irrigation and nitrogen fertilisation studies with maize at Uppington. 1985. A. van Schalkwyk
- V.5211/30/1/2: Summer grain: irrigation and nitrogen fertilisation studies with maize at Vaalharts. 1985. A. van Schalkwyk

## POTENTIAL STUDIES/POTENSIAALSTUDIES

- D.5211/36/1/1: Summer grain: the establishment of maize yield norms in the Stutterheim Extension Ward. 1980. P.G. King
- D.5211/36/2/1: Summer grain: production and economic norms of no-till maize on a commercial scale at Dohne. 1983. J.A.G. Nel

## MODELLING/MODELLERING

- H.5211/42/1/1: The development of a simulation type model to predict production of the more important summer grains in the Highveld Region. 1985. P.J. van Rooyen

## SMALL GRAIN/KLEINGRAAN

### PHYSIOLOGY/FISIOLOGIE

- W.5212/03/1/1: Small grain: the biology of ridgetop brome (*Bromus diandrus*) in the Winter Rainfall Region. 1985. F.H. Eksteen

### NUTRITION/VOEDING

- W.5212/05/1/1: Small grain: the influence of time and amount of application of nitrogen fertiliser on wheat production in the Winter Rainfall Region. 1980. J.W. Loubser

### PATHOLOGY/PATOLOGIE

- V.5212/19/1/1: Small grain: the effect of cultivars, soil/water regime and *Fusarium* inoculum levels at planting time on dryland wheat production at Glen. 1985. O. Los

### PESTS/PLAE

- V.5212/20/1/1: Small grain: investigation on the occurrence of the brown wheat mite under dryland conditions at Glen. 1984. J. de Jager
- V.5212/20/1/2: Small grain: investigations on the effect of the brown wheat mite on grain yield, as well as possible control measures under dryland conditions at Glen. 1984. J. de Jager
- W.5212/20/1/1: Small grain: a study of the identity, occurrence, biology and ecology of aphids on small grain in the Winter Rainfall Region. 1975. S.S. Walters
- W.5212/20/1/2: The pest status of aphids associated with small grain in the Winter Rainfall Region. 1978. S.S. Walters
- W.5212/20/1/3: Small grain: bio-ecological study of *Sitobion avenae* on small grain in the winter rain cropping area of the Winter Rainfall Region. 1984. J.M. Laubscher

## CHEMICAL CONTROL/CHEMIESE BEHEER

- W.5212/21/1/1: Chemical weed control of different broad leaf and grass weeds in small grain production in the Winter Rainfall Region. 1974. J.W. Loubser
- W.5212/21/1/2: The influence of chemical pre-emergence control of weeds on the yield of cereals in the Winter Rainfall Region. 1977. J.W. Loubser

## CROP SCIENCE/GEWASKUNDE

- H.5212/30/1/1: Small grain: verification of production techniques and yield norms for wheat on an Avalon soil form in the Highveld Region. 1985. G.G.J. Oosthuizen
- V.5212/30/1/1: Small grain: irrigation and nitrogen fertilisation studies with wheat in the Lower Orange River area at Upington. 1983. A. van Schalkwyk
- V.5212/30/1/2: Small grain: irrigation and nitrogen fertilisation studies with wheat in the Vaalharts irrigation area. 1983. A. van Schalkwyk
- V.5212/30/1/3: Small grain: irrigation and nitrogen fertilisation studies with wheat grown in rotation with maize at Vaalharts. 1984. A. van Schalkwyk
- V.5212/30/2/1: Small grain: evaluation of crop residue management, soil tillage and wheat control practices within specific systems of dryland wheat production at Glen. 1982. A.J. van der Westhuizen
- V.5212/30/2/2: Small grain: evaluation of minimum tillage and stubble mulch practices in dryland wheat production at Glen. 1984. A.J. van der Westhuizen
- V.5212/30/2/3: Small grain: the effect of different soil management practices during long fallow preceeding dryland wheat on physical soil condition and occurrence of wind erosion at Bainsvlei. 1984. A.J. van der Westhuizen
- V.5212/30/2/4: Small grain: evaluation of minimum tillage and stubble mulch practices in dryland wheat production at Sandvet. 1984. A.J. van der Westhuizen
- W.5212/30/1/1: Small grain: the evaluation of released cultivars in respect of yield and quality in the Winter Rainfall Region. 1974. G.A. Agenbag
- W.5212/30/2/1: Small grain: the influence of sowing date, seeding rate, variety, nitrogen application and disease control on yield and quality of barley in the Winter Rainfall Region. 1974. F.P. Goosen
- W.5212/30/2/2: Small grain: the influence of disease control, nitrogen fertilisation and seeding rate on the yield and nitrogen content of malting barley in the Winter Rainfall Region. 1985. F.P. Goosen
- W.5212/30/2/3: Small grain: the influence of disease control, nitrogen fertilisation and seeding rate on the yield and nitrogen content of malting barley under supplementary irrigation in the Winter Rainfall Region. 1985. F.P. Goosen
- W.5212/30/3/1: Small grain: the influence of sowing time, rate of seeding variety and nitrogen application on yield and quality of wheat in the Winter Rainfall Region. 1985. G.A. Agenbag
- W.5212/30/3/2: Small grain: influence of genotype, environment and nitrogen fertiliser and quality components of wheat in the Winter Rainfall Region. 1985. W.R.M. de Witt
- W.5212/30/4/1: Small grain: the effect of cultivation methods in different cropping systems on grain yield and soil improvement in the Swartland production area of the Winter Rainfall Region. 1975. G.A. Agenbag
- W.5212/30/4/2: Small grain: the effect of cultivation methods in different cropping systems on grain yield and soil improvement in the Ruens production area of the Winter Rainfall Region. 1976. G.A. Agenbag
- W.5212/30/4/3: Small grain: the effect of cultivation methods in different cropping systems on grain yield and soil improvement in the George-Knysna production area of the Winter Rainfall Region. 1979. G.A. Agenbag

OIL AND PROTEIN SEEDS/OLIE- EN PROTEÏENSADE

NUTRITION/VOEDING

- H.5213/05/1/1: Oil and protein seeds: the growth and yield of soybeans on a Bainsvlei soil form in the Highveld Region as influenced by different phosphate levels. 1983. P.J. Laubscher

UPGRADING/VEREDELING

- W.5213/07/1/1: Oil and protein seeds: upgrading of lupins for the winter rain cropping areas by means of genetic studies and breeding. 1981. H.J.C. Agenbag

CROP SCIENCE/GEWASKUNDE

- W.5213/30/1/1: Oil and protein seeds: a study of the adaptability and methods of cultivation of jojoba (*Simmondsia chenensis*) in the Winter Rainfall Region. 1980. D.J. le Roux
- W.5213/30/1/2: Oil and protein seeds: the evaluation of cultivars of different species of lupins with respect to adaptability disease resistance and yield in the Winter Rainfall Region. 1958. H.J.C. Agenbag

OTHER FIELD CROPS/ANDER LANDGEWASSE

NUTRITION/VOEDING

- D.5214/05/1/1: Other field crops: NPK nutrition of chicory at Bathurst. 1980. R.S. Marr

UPGRADING/VEREDELING

- D.5214/07/1/1: Other field crops: upgrading of existing chicory cultivars in the Eastern Cape. 1974. R.S. Marr

CROP SCIENCE/GEWASKUNDE

- D.5214/30/1/1: Other field crops: the contribution of chicory cultivars in the Eastern Cape. 1973. R.S. Marr
- D.5214/30/1/4: Other field crops: crop rotation for chicory in the Eastern Cape. 1980. R.S. Marr
- D.5214/30/1/5: Other field crops: chicory cultivar evaluation in the Eastern Cape. 1974. R.S. Marr
- W.5214/30/1/1: The evaluation of techniques and methods for application of nutrients and irrigation to other crops in a research glasshouse. 1984. H.H.M. van Gelder

Garden crops/Tuingewasse

TUBER CROPS/KNOLGEWASSE

PESTS/PLAE

- T.5221/20/1/1: Tuber crops: the study of the biology of the black maize beetle on potatoes. 1978. H.H. Gouse
- W.5221/20/1/1: Tuber crops: the migratory habits of aphid vectors of potato viruses in the seed potato-producing areas of the winter rain cropping area.



VEGETABLES/GROENTE

PATHOLOGY/PATOLOGIE

- N.5222/19/2/1: Vegetables: effect of different fungicides on the development of late blight, early blight and *Septoria* leaf spot in the vegetable cultivars "Floradade" and "Roma". 1984. W.G. Nevill
- N.5222/19/2/2: Vegetables: cultivar evaluation of vegetables in the mist belt of the high rainfall sourveld areas of Natal and the effects of selected fungicides on foliar disease development. 1985. G.W. Staveley

Fruit crops/Vrugtegewasse

GRAPES/DRUIWE

PESTS/PLAE

- W.5232/20/1/1: Distribution and movement patterns of the Cape sparrow *Passer melanurus* (Müller) - a problem bird of grapes in the irrigation areas of the Winter Rainfall Region. 1985. M.J.F. Jarvis
- W.5232/20/1/2: Food composition and feeding habits of the Cape sparrow *Passer melanurus* (Müller) - a problem bird of grapes in the irrigation areas of the Winter Rainfall Region. 1985. M.J.F. Jarvis
- W.5232/20/1/3: Control techniques for the Cape sparrow *Passer melanurus* (Müller) in grapes in the irrigation areas of the Winter Rainfall Region. 1985. M.J.F. Jarvis

RESOURCE UTILISATION RESEARCH (ANIMALS)/HULPBRON-  
BENUTTINGSNAVORSING (DIERE)

Ruminants/Herkouers

LARGE STOCK/GROOTVEE

PHYSIOLOGY/FISIOLOGIE

- D.5311/03/1/1: Large stock: hormonal status and calving percentage of beef cows and heifers in the sourveld. 1979. J.A. Erasmus
- D.5311/03/1/2: Large stock: protein-energy status and calving percentage of beef cows and heifers in the sourveld. 1980. J.A. Erasmus
- D.5311/03/2/1: Large stock: the influence of kikuyu on the sexual maturity of Friesian heifers. 1984. J.A. Erasmus
- D.5311/03/2/2: Large stock: influence of kikuyu on the protein and energy status as well as certain endocrinological secretions in cows. 1984. J.A. Erasmus
- D.5311/03/2/3: Large stock: influence of kikuyu pastures on the protein and energy status of dairy heifers. 1984. W.P. Henning
- T.5311/03/1/1: Large stock: milk production of beef cattle in the sweet bushveld of Transvaal Region. 1984. C.J.F. Lüdeman
- T.5311/03/1/2: Large stock: influence of different over-wintering feeding regimes on production and growth of beef cattle. 1971. P. Langenegger
- T.5311/03/1/3: Large stock: milk and meat production from a dual purpose breed on natural veld and dryland *Cenchrus* pastures. 1984. F.E. Lademann

## REPRODUCTION/REPRODUKSIE

- N.5311/04/1/1: Effect of preparation feeding levels and target mass at mating on reproduction in female beef cattle. 1979
- N.5311/04/1/2: Oestrus and ovulation in mature female beef cattle as affected by changes in live mass. 1978. B.P. Louw
- N.5311/04/1/4: Large stock: reproduction in the beef female as influenced by bull libido in the high rainfall sourveld area at Dundee. 1983. J.S. Crichton
- V.5311/04/1/1: Large stock: an investigation on practical methods for shortening the inter-calving period of Afrikaner cattle at Armoedsvlakte. 1979. J.A. Vermeulen
- V.5311/04/1/2: Large stock: control of LH release during synchronised oestrus of beef cows at Armoedsvlakte. 1979. J.A. Vermeulen
- V.5311/04/1/3: Large stock: an investigation on the use of gonadotrophin releasing hormone in the application of AI with beef cows at Armoedsvlakte. 1979. J.A. Vermeulen
- V.5311/04/1/4: Large stock: the application of PRID for oestrus synchronisation and the effect on fertility of beef cows at Vaalharts. 1984. J. Grobbelaar

## NUTRITION/VOEDING

- D.5311/05/1/1: Large stock: the relationship in the seasonal variation in beta carotene of sourveld and beta carotene of blood plasma in beef cows. 1983. P.J.L. Zeeman
- D.5311/05/1/2: Large stock: the influence of beta-carotene supplementation on the reproduction of beef cows. 1983. J.A. Erasmus
- D.5311/05/1/3: Large stock: the influence of reproduction on diet selection of beef cattle grazing high rainfall sourveld. 1983. P.J.L. Zeeman
- D.5311/05/1/4: Large stock: the influence of reproduction on diet selection of beef cattle grazing sweet grassveld. 1983. P.J.L. Zeeman
- D.5311/05/2/1: Large stock: the evaluation of kikuyu pastures for milk production. 1984. W.P. Henning
- D.5311/05/2/2: Large stock: the evaluation of kikuyu pastures for dairy heifers. 1984. P.J. Olivier
- D.5311/05/2/3: Large stock: the influence of alkali treatment of whole maize on milk production. 1984. W.P. Henning
- H.5311/05/1/1: Large stock: calf production from the beef herd by means of the optimal summer utilisation of fertilised veld. 1976. J.W. Cilliers
- H.5311/05/1/2: Large stock: optimal summer utilisation of fertilised and unfertilised veld with year-old steers. 1982. A.R. Schutte
- H.5311/05/2/1: Large stock: preservation and protein stabilisation of maize silage. 1978. L.D. Snyman
- H.5311/05/2/2: Large stock: the utilisation of ensiled mixtures of cattle manure and maize crop residues by large stock. 1983. L.D. Snyman
- H.5311/05/3/1: Large stock: the influence of different soybean flour-, whey powder- and colostrum-based milk replacers on post-weaning growth of dairy calves. 1982. C.W. Cruywagen
- H.5311/05/3/2: Large stock: concentrate supplement for dairy bull calves which received different ratios of soymeal, whey powder and colostrum. 1982. C.W. Cruywagen
- H.5311/05/3/3: Large stock: the inclusion of different buffer levels in starter concentrates for dairy calves. 1985. C.W. Cruywagen
- H.5311/05/3/4: Large stock: the effect of curd forming ability of colostrum on the absorption of antibodies in dairy calves. 1985. C.W. Cruywagen

Registered projects/Geregistreerde projekte

- H.5311/05/3/5: Large stock: different concentrate to roughage ratios in complete rations for Friesland bull calves. 1985. C.W. Cruywagen
- H.5311/05/4/1: Large stock: milk production from winter cereal pastures on a shallow Avalon soil in the eastern Free State. 1979. J.W. Cilliers
- H.5311/05/4/2: Large stock: utilisation of *Digitaria eriantha* spp. *eriantha* as grazing crop by dairy cows in the Highveld Region. 1979. Joretha G. Horn
- H.5311/05/4/3: Large stock: milk production with maize silage or pasture as sources of roughage for dairy cows. 1984. Joretha G. Horn
- H.5311/05/5/1: Large stock: the utilisation of cultivated summer pasture by Friesland heifers from weaning up to six months of age. 1985. Joretha G. Horn
- H.5311/05/5/2: Large stock: the utilisation of cultivated winter pasture by Friesland heifers from weaning up to six months of age. 1985. Joretha G. Horn
- H.5311/05/5/3: Large stock: the dry matter intake and mass gain of Friesland heifers (spring calves) from six to 24 months of age on cultivated pasture. 1985. Joretha G. Horn
- H.5311/05/5/4: Large stock: dry matter intake and mass gain of Friesland heifers (autumn calves) from six to 24 months of age on cultivated pasture. 1986. Joretha G. Horn
- H.5311/05/6/1: Large stock: *in vitro* evaluation of the grain of different sorghum varieties for possible inclusion in concentrates of dairy cows. 1985. C.W. Cruywagen
- H.5311/05/7/1: Large stock: beef production from winter cereal pasture on a shallow Avalon soil in the eastern part of the Highveld Region. 1979. J.W. Cilliers
- N.5311/05/1/1: Large stock: the chemical composition and nutritive value of veld for beef cattle in bioregions 3 and 4. 1971. A.D. Lyle
- N.5311/05/2/1: Large stock: evaluation of *E. curvula* silage ensilaged at the May cutting stage for overwintering replacement of beef cattle heifers. 1981. A. van Niekerk
- N.5311/05/2/3: Large stock: utilisation of maize residues by pregnant beef cows in the high rainfall sourveld area at Dundee. 1985. J.S. Chrichton
- .5311/05/3/1: Large stock: chemical composition and nutritive value of kikuyu pasture for lactating dairy cattle in the high rainfall sourveld areas. 1972. T.J. Dugmore
- N.5311/05/3/2: Large stock: chemical composition and nutritive value of Tall Fescue pasture for lactating dairy cattle in the high rainfall area at Cedara. 1980. T.J. Dugmore
- N.5311/05/3/3: Large stock: the causes of nutritional disorders of dairy cattle grazing kikuyu pastures damaged by army worms in the high rainfall sourveld area at Cedara. 1985. S.F. Lesch
- T.5311/05/1/1: Large stock: supplementary feeding of beef cattle cows with calves in the sweet bushveld. 1965. C.J.F. Lüdemann
- T.5311/05/1/2: Large stock: supplementary feeding on sweet bushveld and finishing in pens of growing beef cattle. 1965. C.J.F. Lüdemann
- T.5311/05/1/3: Large stock: supplementary feeding of growing cattle in the high rainfall sourveld. 1971. P. Langenegger
- T.5311/05/2/1: Large stock: the value of bush species for the survival of beef cattle in the bushveld. 1983. G.D. de Bruin
- V.5311/05/1/1: Large stock: the evaluation of the nutritive value of veld with the aim at meat production at Vaalharts. 1974. E.A.N. Engels
- V.5311/05/1/2: Large stock: a study on the influence of phosphorus status on the production and reproduction of beef cattle on veld of Armoedsvlakte. 1978. E.A.N. Engels
- V.5311/05/1/3: Large stock: different levels of phosphorus supplementation of beef cows at Armoedsvlakte. 1984. M.V.P. Read
- V.5311/05/1/4: Large stock: dry matter intake of beef cattle on veld at Glen. 1969. E.A.N. Engels



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- V.5311/05/2/1: Large stock: the application of cultivated roughages for milk production at Glen. 1978. S.W. Matthee
- V.5311/05/2/2: Large stock: the influence of frequency of concentrate feeding on the utilisation of roughage by dairy cows at Glen. 1983. S.W. Matthee
- V.5311/05/2/3: Large stock: the evaluation of annual rye grass for milk production at Glen. 1985. S.W. Matthee
- W.5311/05/1/1: Cultivated kikuyu pastures as a source of food for dairy cows in the Winter Rainfall Region. 1980. P.J. Swart
- W.5311/05/2/1: The substitution of lucerne hay with ammoniated wheat straw as the roughage component in the rations of lactating dairy cows in the Winter Rainfall Region. 1984. E.D. D'Hangest D'yvoy
- W.5311/05/3/1: The economic implications of concentrate and hay supplementation of dairy cows on artificial pastures. 1984. C.J.C. Muller

### UPGRADING/VEREDELING

- D.5311/07/1/1: Large stock: upgrading of the Edelheer and Roodebos Bonsmara breed strains in the high rainfall sourveld area. 1980. A.J. Fourie
- D.5311/07/1/2: Large stock: performance testing of bulls from the Edelheer and Roodebos Bonsmara strains in the high rainfall sourveld area. 1980. J.P. Compaan
- H.5311/07/1/1: Large stock: the influence of genetic and environmental factors on production traits of an Afrikaner cattle herd. 1983. J.J. Viljoen
- H.5311/07/1/2: Large stock: the influence of genetic and environmental factors on production traits of a Simmentaler cattle herd. 1986. J.J. Viljoen
- T.5311/07/1/1: Large stock: the comparison of pure and crossbred beef cattle in different breeding systems for the sweet bushveld. 1965. C.J.F. Lüdemann
- T.5311/07/1/2: Large stock: development and improvement of the Edelheer, Roodebos and Wesselsvlei breeding lines of the Bonsmara beef cattle race in the sour mixed bushveld at Roodeplaat. 1971. G. Marincowitz
- V.5311/07/1/1: Large stock: the use of different beef breeds as sires and dams in pure- and crossbreeding systems at Vaalharts. 1974. D.L. Els
- V.5311/07/1/2: Large stock: crossbreeding with the Afrikaner dam as basis with different large frame breeds under semi-intensive conditions at Vaalharts. 1973. D.L. Els
- V.5311/07/1/3: Large stock: the production potential of female crosses from Afrikaner cows with different large frame beef breeds at Vaalharts. 1976. D.L. Els
- V.5311/07/1/4: Large stock: the evaluation of the Belmont Red and Bonsmara beef breeds under extensive conditions at Vaalharts. 1982. D.L. Els
- V.5311/07/1/5: Large stock: the development and upgrading of the Wesselsvlei strain at Armoedsvlakte. 1980. D.L. Els

### MANAGEMENT/BESTUUR

- N.5311/41/1/3: Large stock: effect of winter growth levels and stocking rates on the highland sourveld on the development of beef cattle heifers. 1981. A. van Niekerk
- N.5311/41/1/4: Large stock: effect of stocking rate on the fertility and performance of beef cattle and the veld in the highland sourveld, 4f, of Natal. 1984. A.D. Lyle
- N.5311/41/3/1: Large stock: effect of shade upon milk production of lactating cattle grazing summer pasture in the high rainfall sourveld areas at Cedara. 1981. T.J. Dugmore
- N.5311/41/3/2: Large stock: data bank for the dairy herd on Cedara.
- N.5311/41/2/1: Large stock: performance of dual purpose and British beef cattle on kikuyu pasture in the high rainfall sourveld area at Cedara. 1975. B.P. Louw

- N.5311/41/2/2: Large stock: beef production on *A. macrum* and *D. eriantha* in bioclimatic region 8 of the high rainfall sourveld. 1983. A.P. van Schalkwyk
- T.5311/41/1/1: Large stock: beef cattle production on natural pasture supplemented with *Cenchrus ciliaris* on the Springbok Flats. 1973. G. Marincowitz
- T.5311/41/1/2: Large stock: a stable beef cattle production system for Mopani veld. 1968. C.J.F. Lüdemann
- T.5311/41/1/3: Large stock: the potential and profit margins of weaner, tollie and ox production systems in the bushveld. 1963. C.J.F. Lüdemann
- V.5311/41/1/1: Large stock: an investigation on the seasonal trend of milk production and the effect of calving date on production on certain selected farms. 1984. J.P. Lessing
- W.5311/41/1/1: Large stock: evaluation of shelters for dairy cows in the Winter Rainfall Region. 1981. C.J.C. Muller
- W.5311/41/1/2: Large stock: the determination of the effect of a shade structure in open camps on the milk and reproduction parameters of lactating dairy cows in the Winter Rainfall Region. 1985. C.J.C. Muller
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### Non-ruminants/Nie-herkouers

#### OSTRICHES/VOLSTRUISE

##### REPRODUCTION/REPRODUKSIE

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##### NUTRITION/VOEDING

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##### NUTRITION/VOEDING

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OTHER ANIMALS/ANDER DIERE

UPGRADING/VEREDELING

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RESOURCE UTILISATION RESEARCH (PASTURES)/HULPBRON-  
BENUTTINGSNAVORSING (WEIDING)

Pasture/Weiding

VELD

TAXONOMY/TAKSONOMIE

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## CHEMICAL CONTROL/CHEMIESE BEHEER

- K.5411/21/1/1: Veld: chemical control of mesquite (*Prosopis* spp.) in the north-western Karoo. 1976. M. Vorster
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- H.5411/27/1/3: Veld: growth curves of certain preferred grasses on different veld units. 1986. S.L. van Schalkwyk
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## CROP SCIENCE/GEWASKUNDE

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- D.5411/30/1/3: Veld: growth patterns of *Acacia karroo* in the central grassveld areas of the Eastern Cape. 1982. W.R. Teague
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- D.5411/30/1/5: Veld: the effect of different frequencies and intensities of defoliation under a wet and dry moisture regime on the above-ground parts of *Acacia karroo* in the central grassveld areas of the Eastern Cape. 1982. W.R. Teague
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- D.5411/31/1/4: Veld: water use by *A. karroo* as influenced by defoliation. 1984. W.R. Teague

## SOIL SCIENCE/GRONDKUNDE

- D.5411/32/1/1: Veld: study of soil factors which affect species composition of the veld in the central grassveld areas. 1982. G. Stuart-Hill

## AGROHYDROLOGY/AGROHIDROLOGIE

- D.5411/34/1/1: Veld: the rate and depth of water infiltration following rain on the Adelaide Experiment Farm. 1982. G. Stuart-Hill

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- D.5411/36/1/1: Veld: the browse grazing capacity of the Valley bushveld in the Eastern Cape Region. 1984. A.J. Aucamp
- D.5411/36/2/1: Veld: herbage yield and growth curves of various swards dominated by key grass species in the central grassveld areas. 1980. J.E. Danckwerts
- D.5411/36/2/2: Veld: the influence of seasonal defoliation of either the *Acacia karroo*, the herbaceous component, or both on browse and grass production. 1982. G. Stuart-Hill

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- K.5411/36/1/1: Veld: determination of biomass and production in eleven veld types in the Karoo Region. 1978. P. Botha
- K.5411/36/1/2: Veld: determination of the biomass and production of the vegetation in the Meentspruit farming unit. 1980. P. Botha
- K.5411/36/2/1: Veld: determination of relative grazing value indices for the different plant ecological groups in the eastern mixed Karoo. 1983. M. Vorster
- K.5411/36/2/2: Veld determination of relative grazing value indices for the different plant ecological groups in the north-western Karoo. 1983. M. Vorster
- K.5411/36/2/3: Veld: determination of relative grazing value indices for the different plant ecological groups in the eastern Karoo mountain areas. 1983. M. Vorster
- K.5411/36/2/4: Veld: determination of relative grazing value indices for the different plant ecological groups in the Great Karoo. 1983. M. Vorster
- T.5411/36/1/1: Veld: the biomass dynamics of the most important grass species on debushed and non-debushed *Combretum* veld pastures. 1981. G.T. Rootman
- T.5411/36/1/2: Veld: production potential and quality of debushed and non-debushed *Combretum* veld pastures. 1981. G.T. Rootman
- T.5411/36/1/3: Veld: experimental cattle ranch on veld pastures in the bushveld at Soutpan. 1964. G. Marincowitz
- T.5411/36/2/1: Veld: veld observation of selection patterns of grazing animals on veld pastures in the South-eastern Transvaal. 1971. N.F.G. Rethman
- T.5411/36/2/2: Veld: an oesophageal fistula sample investigation of plant species selection on veld pastures in the South-eastern Transvaal. 1971. N.F.G. Rethman
- V.5411/36/1/1: Veld: the determination of norms to determine the carrying capacity of the veld at Armoedsvlakte. 1977. J.H. Fourie
- V.5411/36/1/2: Veld: determination of norms to determine the carrying capacity of veld with cattle and sheep at Glen. 1985. J.H. Fourie
- V.5411/36/1/3: Veld: monitoring of influence of game on veld in the Spitskop Nature Reserve at Upington. 1983. J.H. Fourie
- V.5411/36/1/4: Veld: the monitoring of the effect of game on veld in the Leon Taljaard Reserve at Vryburg. 1983. J.H. Fourie
- V.5411/36/1/5: Veld: the determination of norms for the estimation of the carrying capacity of *Tarchonanthus* veld for Dorper sheep at Koopmansfontein. 1985. J.H. Fourie
- V.5411/36/1/6: Veld: an investigation of the production of veld invaded by *Acacia karroo* when utilised by Boer goats. 1983. L. Viljoen
- V.5411/36/1/7: Veld: determination of grazing capacity and veld condition benchmarks of the main veld ecotopes in the central grassveld areas of the Free State Region. 1985. H.J. Fouché
- V.5411/36/1/8: Veld: the determination of grazing capacity and veld condition benchmarks of the main veld ecotopes in the bushveld areas of the Free State Region. 1985. H.J. Fouché
- V.5411/36/1/9: Veld: the determination of grazing capacity and veld condition benchmarks of the main veld ecotopes in the Karoo and arid areas of the Free State Region. 1985. H.J. Fouché

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- D.5411/41/1/1: Veld: the effect of intensity of defoliation on key grass species. 1981. J.E. Danckwerts
- D.5411/41/1/2: Veld: the effect of intensity of defoliation on animal performance. 1981. J.E. Danckwerts

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- D.5411/41/1/3: Veld: selection and composition rates of *A. karroo* communities by goats on a function stocking pressure. 1984. W.R. Teague
- H.5411/41/1/2: Veld: the mass changes of steers when they graze camps for different periods of time. 1971. R.H. Drewes
- H.5411/41/1/4: Veld: the utilisation of veld when infested with *Pachystigma pygmaeum*. 1969. R.H. Drewes
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- K.5411/41/1/2: Veld: determination of animal ratio on a mixed Karoo bushveld in the north-western Karoo based on the selection by Afrino, Dorper and Merino sheep and Angora goats. 1984. P. Botha
- K.5411/41/1/3: Veld: a study of the physical effect of grazing by sheep on different soil types in the Karoo areas. 1984. G. v.N. du Toit
- N.5411/41/1/1: Veld: burning and mowing in bioclimate 4e at Thabamhlope. 1944. B.D. Mappedoram
- N.5411/41/1/2: Regrowth rates of veld burnt at various times in spring. 1981. P.C.V. du Toit
- N.5411/41/1/3: Beef steers grazing sour sandveld. 1981. P.C.V. du Toit
- N.5411/41/1/4: Evaluation of veld potential with beef animals at Kokstad. 1979. M.B. Hardy
- T.5411/41/1/1: Veld: continuous and fixed seasonal rotational grazing systems for veld pastures in the bushveld. 1935. G.T. Rootman
- T.5411/41/1/2: Veld: selection of trees, shrubs, forbs and grasses by Boer goats in the Mopani bushveld. 1985. C.J.F. Lüdemann
- T.5411/41/2/1: Veld: influence of winter defoliation on the grass sward of sourveld pastures of South-eastern Transvaal. 1968. N.F.G. Rethman
- T.5411/41/2/2: Veld: development of a veld utilisation system with the elimination of untimely burns for the extensive grassveld pasture of South-eastern Transvaal. 1969. N.F.G. Rethman
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- W.5411/41/1/1: Veld: the effect of grazing by small stock and cattle on the cover and composition of Strandveld. 1972. S.A. Barnard
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- W.5411/41/1/3: Veld: the evaluation and seed multiplication of natural pasture species at Worcester Veld Reserve. 1977. S.A. Barnard
- W.5411/41/1/4: Veld: nursery - Nortier Experiment Station. 1979. S.A. Barnard

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- D.5411/42/1/1: Veld: a model simulating the effect of probable uses of the natural vegetation in the bush-grass communities of the Eastern Cape. 1984. W.R. Teague
- N.5411/42/1/1: Determination of the relationship between veld condition, slope, soil erodibility and grazing capacity. 1980. P.C.V. du Toit
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- K.5411/52/1/1: Veld: the development of a technique to measure the utilisation of Karoo bushes. 1985. F.D. Hobson



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## RADICAL VELD IMPROVEMENT/RADIKALE VELDVERBETERING

### CROP SCIENCE/GEWASKUNDE

- T.5412/30/1/1: Radical veld improvement: introduction of rhigomatous grasses into the sourveld of South-eastern Transvaal. 1968. N.F.G. Rethman
- T.5412/30/1/2: Radical veld improvement: establishment of perennial subtropical legume introductions into the natural veld of South-eastern Transvaal. 1974. N.F.G. Rethman
- T.5412/30/1/3: Radical veld improvement: introductions of kikuyu in the veld of the South-eastern Transvaal. 1972. N.F.G. Rethman

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- T.5412/36/1/1: Radical veld improvement: comparison of subtropical legume (*Vigna vescillata*) reinforced veld with natural veld for autumn grazing by sheep. 1973. N.F.G. Rethman

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- W.5412/41/1/1: The evaluation of *Chrysanthemoides*, *Medicago* and *Atriplex* species for radical veld improvement in the sandveld of the Strandveld. 1978. S.A. Barnard
- W.5412/41/1/2: The evaluation and seed multiplication of natural pastures species at the Oudtshoorn Experiment Farm for planting in the Klein Karoo subregion. 1985. S.A. Barnard

## CULTIVATED PASTURE/AANGEPLANTE WEIDING

### NUTRITION/VOEDING

- D.5413/05/1/1: Cultivated pasture: the yield of Rhodes grass at various nitrogen and phosphate levels at Bathurst. 1981. C.J.G. le Roux
- D.5413/05/1/2: Cultivated pasture: the yield of Coastcross II at various nitrogen and phosphate levels at Bathurst. 1983. C.J.G. le Roux
- D.5413/05/1/3: Cultivated pasture: the yield of *Eragrostis curvula* at various nitrogen and potassium levels at Dohne. 1985. L.G. Howe
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- N.5413/05/1/2: Phosphorus and lime nutrition of *Trifolium* pasture on dystrophic soils. 1976. N. Miles
- N.5413/05/1/3: Effect of various levels of N, P and K on the productivity of Coastcross II pastures. 1974. P.E. Bartholomew
- N.5413/05/1/4: Phosphorus and potash requirements of *Eragrostis curvula* pastures on Leksand soils. 1974. P.E. Bartholomew
- N.5413/05/1/5: N, P, K and lime for *Eragrostis curvula* pastures. 1974. P.E. Bartholomew
- N.5413/05/1/6: Ameliorative requirements of highly weathered soil and the N, P and lime requirements for *Pennisetum clandestinum* pastures. 1981. N. Miles
- N.5413/05/1/7: Nutritional requirements of established kikuyu pastures: response to top-dressing. 1981. N. Miles

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- N.5413/05/1/10: Response of white clover pastures to P, K and lime on a highly leached soil. 1983. N. Miles
- N.5413/05/1/12: Response of Midmar Italian rye grass pasture to N, P and K fertilisation. 1985. N. Miles
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- T.5413/05/1/1: Cultivated pasture: distribution of phosphatic fertiliser on *Eragrostis curvula* in the Drakensberg grazing region. 1971. N.F.G. Rethman
- T.5413/05/1/2: Cultivated pasture: comparison of hay breeding practices in the evaluation of "feedback" on *Eragrostis curvula* hay pastures in the Drakensberg grazing region. 1973. N.F.G. Rethman
- T.5413/05/1/3: Cultivated pasture: phosphate fertilisation of *Eragrostis curvula* in the Drakensberg grazing area. 1969. N.F.G. Rethman
- T.5413/05/1/4: Cultivated pasture: influence of level and distribution of nitrogenous fertiliser on the production and composition of kikuyu through the year. 1974. N.F.G. Rethman
- T.5413/05/1/5: Cultivated pasture: tests on the acid sensitivity of various grazing cultures. 1985. D.F. de Wet
- V.5413/05/1/1: Cultivated pasture: determination of fertiliser requirements of *Antheophora pubescens* in terms of N, P and K on a soil of the Mangano series at Vaalharts. 1976. J.H. Fourie
- V.5413/05/1/2: Cultivated pasture: determination of nutrient requirements of *Sporobolus fimbriatus* by means of pot experiments at Glen. 1981. L. Viljoen
- V.5413/05/1/3: Cultivated pasture: an investigation on the nutrient requirements of *Panicum maximum* Jacq. cv. Sabi in sand and soil cultures at Glen. 1983. L.G. du Pisani
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- V.5413/05/1/6: Cultivated pasture: an investigation on the effect of soil pH and fertilisation on the production, digestibility and chemical composition of *Antheophora pubescens* Nees (VH20) in soil cultures at Glen. 1983. L.G. du Pisani
- W.5413/05/1/2: A study of the nitrogen fertiliser requirements of pastures in the irrigation areas of George. 1979. J.D. Langenhoven

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- N.5413/07/1/1: Cultivated pasture: breeding and selection of *Paspalum dilatatum*. 1959. A. Smith
- N.5413/07/1/2: Cultivated pasture: breeding and selection of *Dactylis glomerata*. 1959. D.C.W. Goodenough
- N.5413/07/1/3: Cultivated pasture: breeding and selection of *Lolium multiflorum*. 1959. D.C.W. Goodenough
- N.5413/07/1/4: Cultivated pasture: breeding and selection of *Eragrostis curvula*. 1970. D.C.W. Goodenough
- N.5413/07/1/5: Cultivated pasture: breeding and selection of *Acroceras macrum*. 1979. A. Smith

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- N.5413/07/1/6: Cultivated pasture: breeding and selection of *Digitaria eriantha*. 1974. G.F. Watt-Pringle
- N.5413/07/1/7: Cultivated pasture: breeding and selection of *Trifolium* spp. 1977. A. Smith
- N.5413/07/1/8: Cultivated pasture: breeding and selection of *Festuca arundinacea*. 1978. A. Smith
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- N.5413/07/1/10: Cultivated pasture: *Lolium multiflorum* cultivars for improved autumn, winter and summer growth. 1982. G.F. Watt-Pringle
- N.5413/07/2/1: Tissue and anther culture in white clover. 1981. G.F. Watt-Pringle
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## NITROGEN FIXATION/STIKSTOFBINDING

- N.5413/09/1/1: Cultivated pasture: selection of *Rhizobium* strains for *Trifolium*. 1967. A. Smith

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- N.5413/19/1/1: Cultivated pasture: pathological survey of *P. clandestinum*, *E. curvula* and *L. multiflorum*. 1983. A.S. Hall
- N.5413/19/1/3: Cultivated pasture: fungicidal control of *Drechslera* and *Puccinia* on *Lolium* spp. 1985. A.S. Hall
- N.5413/19/1/4: Cultivated pasture: the effect of seed treatments on *Lolium multiflorum* herbage yields. 1985. A.S. Hall

## PESTS/PLAE

- W.5413/20/1/1: Control of the lucerne springtail *Smithurus viridis* (L.) and the black sandmite *Halotydeus destructor* (Tucker) in the winter rain cropping area. 1960. J. Lombaard

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- D.5413/21/1/1: Cultivated pasture: screening pasture plants for tolerance to Tetrapion. 1983. C.J.G. le Roux
- D.5413/21/1/2: Cultivated pasture: preliminary assessment of herbicides for use in legume pasture in the high rainfall sourveld areas of the Eastern Cape. 1984. L.G. Howe
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- D.5413/30/1/1: Cultivated pasture: maintenance and development of the pasture nursery at Bathurst. 1976. T. Daines



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- D.5413/30/1/3: Cultivated pasture: maintenance and development of the pasture nursery at Clifford. 1983. C.J.G. le Roux
- D.5413/30/2/1: Cultivated pasture: seeding rate and weed control in the establishment of Rhodes grass. 1980. T. Daines
- H.5413/30/1/3: Cultivated pasture: the evaluation of different *Digitaria* species. 1980. R.H. Drewes
- H.5413/30/1/5: Cultivated pasture: the value of seven perennial grasses on three marginal cropping soils. 1985. C.J. Haefele
- H.5413/30/2/1: Cultivated pasture: the evaluation of Smuts finger grass in combination with lucerne as pasture. 1981. R.H. Drewes
- N.5413/30/1/1: Preliminary evaluation of the pasture plant material centre in the Tall Grassveld. 1972. B.D. Mappedoram
- N.5413/30/1/2: Evaluation of pasture plants in Natal. 1970. B.D. Mappedoram
- N.5413/30/3/1: Cultivated pasture: legumes suitable for kikuyu pastures. 1978. C.I. MacDonald
- N.5413/30/3/2: Cultivated pasture: management of red clover in kikuyu pasture. 1981. C.I. MacDonald
- N.5413/30/4/1: Cultivated pasture: *Lolium multiflorum* seed production. 1981. D.C.W. Goodenough
- N.5413/30/4/2: Cultivated pasture: *Trifolium repens* seed production. 1981. A. Smith
- N.5413/30/5/1: Cultivated pasture: herbage production trials for the selection of *Dactylis glomerata* pasture. 1977. B.D. Mappedoram
- N.5413/30/5/2: Cultivated pasture: herbage production trials for the selection of *Festuca arundinacea* pasture. 1978. B.D. Mappedoram
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- N.5413/30/5/12: Classification, processing and assessment of available data of cultivated pasture species. 1976. E.N. Boeke
- N.5413/30/5/13: Cultivated pasture: foggage value of cultivated pastures in the Natal midlands. 1977. P.C.V. du Toit
- N.5413/30/5/14: Cultivated pasture: foggage value of pastures at Kokstad. 1981. N.N. Gray
- N.5413/30/5/15: Cultivated pasture: temperate pastures under irrigation in bioclimate 4e. 1980. T.M. du Plessis
- N.5413/30/5/16: Cultivated pasture: effect of different sites on the production of various pasture species in bioclimate 3. 1980. G.F. Watt-Pringle
- N.5413/30/7/1: Cultivated pasture: growth and development of kikuyu pastures. 1981. P.C.V. du Toit
- T.5413/30/1/1: Cultivated pasture: height and stage of cutting of *Eragrostis curvula* in the Drakensberg grazing region. 1969. N.F.G. Rethman
- T.5413/30/1/2: Cultivated pasture: influence of burning nitrogen and height of cutting on the seed production of *Eragrostis curvula* in the Drakensberg grazing region. 1973. N.F.G. Rethman
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- V.5413 30 1/1: Cultivated pasture: phase-I evaluation of pasture plants at Armoedsvlakte. 1974. J.H. Fourie

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- T.5413/36/1/1: Cultivated pasture: dry matter production and nutritional value of stoloniferous *Digitaria* introductions. 1975. G.T. Rootman
- T.5413/36/1/2: Cultivated pasture: dry matter production and nutritional value of *Panicum maximum* introductions. 1975. G.T. Rootman
- T.5413/36/1/3: Cultivated pasture: performance of *Cenchrus ciliaris* as a summer pasture in the bushveld. 1972. G.T. Rootman
- T.5413/36/2/1: Cultivated pasture: the influence of level of fertilisation and harvest stage on the feeding value of *Eragrostis curvula* in the Drakensberg grazing region. 1976. N.F.G. Rethman
- T.5413/36/2/2: Cultivated pasture: determination of the production potential of grasses for irrigated pastures in the South-eastern Transvaal. 1973. N.F.G. Rethman
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- T.5413/36/2/5: Cultivated pasture: evaluation of legumes in a kikuyu pasture mixture. 1973. N.F.G. Rethman
- T.5413/36/2/6: Cultivated pasture: the potential of *Digitaria eriantha* and a mixture of *D. eriantha* and *Medicago sativa* for woolled sheep. 1984. C.C. de Witt
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- N.5413/38/1/1: Making silage from Italian rye grass pastures. 1983. P.C.V. du Toit
- D.5413/41/1/5: Cultivated pasture: evaluation of the Rhodes grass for beef production in the eastern coastal areas of the Eastern Cape. 1980. T. Daines
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- D.5413/41/1/9: Cultivated pasture: growth patterns of summer grasses at Dohne. 1979. C.J.G. le Roux
- D.5413/41/1/10: Cultivated pasture: potential of temperate grasses at Dohne. 1979. C.J.G. le Roux

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- N.5413/41/1/4: Cultivated pasture: *Festuca arundinacea* pasture with and without legumes at the stocking rates in bioclimate 3. 1981. T.M. du Plessis
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- N.5413/41/1/7: Cultivated pasture: cows and calves on various pastures in bioclimate 4e. 1972. B.D. Mappedoram
- N.5413/41/1/8: Cultivated pasture: steers on star grass pasture at the stocking rates in bioclimate 6. 1979. P.E. Bartholomew
- N.5413/41/1/9: Cultivated pasture: effect of stocking rate on the performance of weaners on irrigated *Lolium multiflorum* pastures in bioclimate 3. 1981. M.B. Hardy
- N.5413/41/1/10: Cultivated pasture: effect of stocking rate and nitrogen fertiliser on the performance of steers on *Digitaria eriantha* and *Eragrostis curvula*/legume pastures in bioclimate 4f. 1982. M.B. Hardy
- N.5413/41/1/11: Cultivated pasture: effect of stocking rate and nitrogen fertiliser on the performance of weathers on various pastures on upland and bottomland sites in bioclimate 4f. 1974. P.C.V. du Toit
- N.5413/41/1/12: Cultivated pasture: fertilisation of old land pastures under grazing in bioclimate 8. 1980. P.E. Bartholomew
- N.5413/41/1/13: Cultivated pasture: characterisation of various pasture species under different management systems and stocking rates. 1980. P.E. Bartholomew
- T.5413/41/1/1: Cultivated pasture: development of a practical acceptable beef/sheep farming system based on planted grasses. 1973. N.F.G. Rethman
- T.5413/41/1/3: Cultivated pasture: evaluation of *Eragrostis curvula* for intensive sheep production in South-eastern Transvaal. 1972. N.F.G. Rethman



## Registered projects/Geregistreeerde projekte

- T.5413/41/1/4: Cultivated pasture: optimisation of grazing management of *C. varia* in the summer rain cropping area of Transvaal Region. 1985. D.L. Barnes
- T.5413/41/2/2: Cultivated pasture: a comparison of grazing/fodder types and their combinations for animal production by means of slaughter lambs. 1984. D.F. de Wet
- V.5413/41/1/1: Cultivated pasture: a comparison of veld and veld in combination with cultivated pastures in terms of beef production at Armoedsvlakte. 1974. J.H. Fourie
- W.5413/41/1/1: Evaluation of kikuyu as a pasture crop under irrigation in the Stellenbosch area. 1982. J.D. Langenhoven
- W.5413/41/1/2: The evaluation of pasture legumes and grasses under irrigation in the Winter Rainfall Region by means of cutting methods. 1979. J.M. van Heerden
- W.5413/41/1/3: The carrying capacity of grass/legume pastures under irrigation using different grazing methods in the Ruens area. 1979. J.M. van Heerden
- W.5413/41/1/4: The evaluation of grass/legume pastures under irrigation and dryland conditions and different grazing practices in the George area. 1983. J.M. van Heerden
- W.5413/41/1/5: Carrying capacity of artificial pasture, small grain rotation in the Ruens area. 1972. J.D. Langenhoven
- W.5413/41/1/6: Determination of the carrying capacity of dryland artificial grass/legume pastures at Tygerhoek in the Ruens area. 1979. J. M. van Heerden
- W.5413/41/1/7: Comparison of the carrying capacity of dryland pasture mixtures under different soil-climate conditions in the Ruens area. 1982. J.M. van Heerden
- W.5413/41/1/8: Determination of the optimum sowing time and sowing density for medics in the Swartland. 1981. J.D. Langenhoven
- W.5413/41/1/9: Investigation of new dryland cultivated pasture crops in the Swartland and Boland areas. 1973. J.D. Langenhoven
- W.5413/41/1/10: Investigation of new dryland cultivated pasture crops at Elsenburg and in the Ruens area. 1973. J.M. van Heerden
- W.5413/41/1/11: Investigation of dryland cultivated pasture crops for the eastern seaboard area of the Winter Rainfall Region by cutting methods. 1973. J.M. van Heerden
- W.5413/41/1/12: Investigation of new cultivated pasture crops for the Karoo and arid areas of the Winter Rainfall Region by cutting methods. 1973. J.D. Langenhoven

## CHEMISTRY/CHEMIE

- N.5413/53/1/1: Cultivated pasture: to determine the correlation between *in vitro* digestion and animal production of pasture crops. 1978. J.P. Marais
- N.5413/53/1/2: Cultivated pasture: the determination of the effect of nitrogen containing fractions of kikuyu on animal production. 1979. Maria D.S. Dos Anjos Santos
- N.5413/53/1/3: Cultivated pasture: determination of factors influencing the preparation of high quality kikuyu silage. 1979. Maria D.S. Dos Anjos Santos

## LUCERNE/LUSERN

### UPGRADING/VEREDELING

- K.5414/07/1/1: Lucerne: lucerne breeding. 1935. G.C. de Kock
- K.5414/07/1/2: Lucerne: selection for resistance to salinity and moisture stress. 1962. G.C. de Kock

### PESTS/PLAE

- V.5414/20/1/1: Lucerne: investigation on the occurrence and distribution of the white fringed beetle on lucerne in the Lower Orange River irrigation area. 1985. J. de Jager

## CHEMICAL CONTROL/CHEMIESE BEHEER

- W.5414/21/1/1: Lucerne: phytotoxicity and efficiency of the present and new weedicides in lucerne in the Oudtshoorn irrigation area. 1985. D.J. le Roux

## CROP SCIENCE/GEWASKUNDE

- H.5414/30/1/1: Lucerne: the national lucerne evaluation. 1981. R.H. Drewes
- H.5414/30/2/1: Lucerne: the influence of frequency of defoliation on the production and quality of dryland lucerne. 1984. E.A. Schwiering
- H.5414/30/3/1: Lucerne: the value of Pierce lucerne on three soil series as a dry land pasture for ewes and lambs in the Highveld Region. 1985. A.S. de Beer
- T.5414/30/1/1: Lucerne: cultivation of lucerne on different ecological units with different espacements and seeding rates. 1975. J.J. Odendaal
- V.5414/30/1/1: Lucerne: an investigation of the adaptability of lucerne cultivars which are resistant to the blue-green aphid and pea aphid under irrigation at Upington. 1982. L.G. du Pisani
- V.5414/30/1/2: Lucerne: an investigation of the adaptability of lucerne cultivars resistant to the blue-green aphid and pea aphid under dryland conditions. 1984. L.G. du Pisani
- V.5414/30/1/3: Lucerne: an investigation of the adaptability of lucerne cultivars which are resistant to the blue-green aphid and pea aphid under irrigation at Vaalharts. 1982. L.G. du Pisani
- V.5414/30/2/1: Lucerne: to determine the optimal row spacings and seeding rates for lucerne under dryland conditions at Glen. 1983. L.G. du Pisani
- V.5414/30/2/2: Lucerne: the influence of the frequency of interrow cultivation on the production of dryland lucerne under cultivation at Glen. 1983. L.G. du Pisani

## SOIL SCIENCE/GRONDKUNDE

- D.5414/32/1/1: Lucerne: the effect of acid soil condition on above and below ground growth and development of lucerne with special reference to seeding establishment at Dohne. 1984. G.R. Barnes

## MANAGEMENT/BESTUUR

- W.5414/41/1/1: Lucerne: an evaluation of the resistance to grazing of new lucerne cultivars under dryland conditions in the Ruens area. 1985. J.D. Langenhoven

## ANNUAL FODDER CROPS/EENJARIGE VOERGEWASSE

### CROP SCIENCE/GEWASKUNDE

- H.5415/30/1/1: Annual fodder crops: the influence of time of establishment on the production of annual winter fodder crops. 1977. R.H. Drewes
- H.5415/30/1/2: Annual fodder crops: the influence of fertilisation and cutting frequency on the production of five rye grasses with limited irrigation. 1985. A.S. de Beer
- H.5415/30/2/1: Annual fodder crops: the influence of planting date and soil serie on the production of fodder sorghums and babala. 1984. E.A. Schwiering

### POTENTIAL STUDIES/POTENSIAALSTUDIES

- T.5415/36/1/1: Annual fodder crops: evaluation of *Pennisetum typhoides* as a fodder crop. 1977. G.T. Rootman

MANAGEMENT/BESTUUR

- K.5415/41/1/1: Annual fodder crops: green material production of winter cereal cultivars and lines under irrigation in the irrigation areas in the Karoo Region. 1961. G.C de Kock
- W.5415/41/1/1: Evaluation of annual fodder legume crops. 1979. J.D. Langenhoven

DROUGHT FODDER CROPS/DROOGTE VOERGEWASSE

UPGRADING/VEREDELING

- K.5416/07/1/1: Drought fodder crops: collection and evaluation of plants as drought fodder crops. 1964. G.C. de Kock
- K.5416/07/1/2: Drought fodder crops: the improvement of spineless cactus (*Opuntia* spp.) through breeding and selection. 1964. G.C. de Kock
- K.5416/07/1/3: Drought fodder crops: the improvement of *Atriplex nummularia* through breeding and selection. 1964. G.C. de Kock

LEGUME FODDER CROPS/VOERPEULGEWASSE

CROP SCIENCE/GEWASKUNDE

- T.5417/30/1/1: Legume fodder crops: determination of inoculation requirements of pasture and fodder legumes. 1977. V.D. Wassermann
- T.5417/30/1/2: Legume fodder crops: determination of daylength and temperature requirements for normal flowering in specific pasture and fodder legumes. 1977. V.D. Wassermann
- T.5417/30/1/3: Legume fodder crops: screening of pasture legumes for soil acidity tolerance. 1977. V.D. Wassermann
- T.5417/30/1/4: Legume fodder crops: a study of the effects of N fertilisation on the productivity of a white clover grass pasture. 1981. V.D. Wassermann
- T.5417/30/1/6: Legume fodder crops: a study of the interrelation between respectively, *Trifolium vesiculosum* and *Trifolium subterraneum* and *Lolium multiflorum* cv. Midmar in mixtures. 1983. Marike van den Berg
- T.5417/30/1/7: Legume fodder crops: the effect of babala (*Pennisetum americanum*) as support crop, nitrogenous fertiliser and seed rate on the growth and production of dolichos bean (*Lablab purpureus*). 1983. A.J. Kruger
- T.5417/30/2/1: Legume fodder crops: nursery trials with pasture and fodder legumes. 1978. A.J. Kruger
- T.5417/30/2/2: Legume fodder crops: yield studies with tropical and subtropical pasture and fodder legumes at Rietondale. 1978. A.J. Kruger
- T.5417/30/2/3: Legume fodder crops: yield trials with temperate legumes. 1978. A.J. Kruger
- T.5417/30/2/4: Legume fodder crops: calibration of Neotec 4250 near infra-red forage analyser for the complete analysis of forage and pasture samples. 1985. M.A. Stoltz

RESOURCE UTILISATION RESEARCH (FARMING SYSTEMS)  
HULPBRONBENUTTINGSNAVORSING (BOERDERYSTELSELS)

Farming enterprises/Boerderyvertakings

STOCK AND GAME FARMING/VEE- EN WILDBOERDERY

POTENTIAL STUDIES/POTENSIAALSTUDIES

- D.5511/36/1/1: Stock and game farming: development of a viable stock farming system for the Valley Bushveld in good condition in the Eastern Cape Region. 1983. A.J. Aucamp



## Registered projects/Geregistreerde projekte

- D.5511/36/1/2: Stock and game farming: development of a viable stock farming system for the Valley Bushveld in a poor condition in the Eastern Cape Region. 1983. A.J. Aucamp
- D.5511/36/1/3: Stock and game farming: development of a viable stock farming system for the dry grass-bush communities of the Eastern Cape Region. 1976. A.J. Aucamp
- D.5511/36/1/4: Stock and game farming: the development and management of an adapted stock farming system Campagna for the high rainfall sourveld. 1983. H.H. Barnard
- D.5511/36/2/1: Stock and game farming: the potential of cultivated pastures in terms of small stock. 1976. A.J. Fourie

### MANAGEMENT/BESTUUR

- H.5511/41/1/1: Stock and game farming: the influence of different feeding strategies on the economic and biological efficiency of beef cattle farming. 1982. R.H. Drewes
- H.5511/41/2/1: Stock and game farming: the influence of different feeding strategies on the economic and biological efficiency of woolled sheep farming. 1985. B.G.J. van Vuuren

### CROP FARMING/SAAIBOERDERY

#### CROP SCIENCE/GEWASKUNDE

- V.5512/30/1/1: Crop farming: evaluation of crop succession systems in which wheat and maize are grown under dryland conditions at Glen. 1982. C. Engelbrecht

### MIXED FARMING/GEMENGDE BOERDERY

#### MANAGEMENT/BESTUUR

- D.5513/41/1/1: The compilation of a manual to promote mixed farming production techniques in the Tsitsikamma area. 1983. P.G. King
- D.5513/41/1/2: The compilation of a manual to promote mixed farming production techniques in the Alexandria area. 1983. P.G. King
- D.5513/41/1/3: The compilation of a manual to promote mixed farming production techniques in the Paterson area. 1983. P.G. King
- D.5513/41/1/4: The compilation of a manual to promote mixed farming production techniques in the Queenstown sweet thornveld. 1983. P.G. King
- D.5513/41/2/1: Mixed farming: the development of a production plan for the farm Granta. 1984. P.G. King
- W.5513/41/1/1: Mixed crop and animal production practices for optimum land utilisation in the Swartland. 1973. J.D. Langenhoven
- W.5513/41/1/2: A study of soil fertility in the Swartland and Rûens area using legume crops in rotation with small grain. 1978. J.D. Langenhoven

## AGRICULTURAL PRODUCTION ECONOMICS RESEARCH LANDBOUPRODUKSIE-EKONOMIENAVORSING

### Macro resource economics/Makrohulpbronekonomie

#### PRODUCTION FACTOR STUDIES/PRODUKSIEFAKTORSTUDIES

#### PRODUCTION ECONOMICS/PRODUKSIE-EKONOMIE

- PE.5611/48/1/1: Production factor studies: the determination of a remuneration for the management function in agricultural concerns. 1980. J.S.G. Joubert

- PE.5611/48/2/1: Production factor studies: the determination of the value of agriculture land in the RSA. 1976. A.H. Poray
- PE.5611/48/2/2: Production factor studies: the determination of rental tariffs and parameters for realistic rental tariffs for farm land. 1980. A.H. Poray
- PE.5611/48/2/3: Production factor studies: determination of the economic value of irrigation water in the upper Berg River and Eerste River Valley. 1982. J.M. van Zyl

#### STRUCTURAL STUDIES/STRUKTUURSTUDIES

##### PRODUCTION ECONOMICS/PRODUKSIE-EKONOMIE

- PE.5612/48/1/4: An evaluation of present methods used and standards required in determining a minimum economically farm unit. 1984. S.M. Beghin
- PE.5612/48/3/1: Structural studies: determination of the extent nature and efficiency level of part-time farming in the RSA. 1980. J. Hough
- PE.5612/48/3/2: Structural studies: an evaluation of the efficiency of part-time farmers in the North-western Transvaal bushveld. 1979. P.F. du Plessis
- PE.5612/48/3/4: Structural studies: research in respect of the financial rehabilitation of crop farmers with liquidity problems. 1985. C.W. Mostert

#### Farm business management/Plaasbedryfsleer

##### BUSINESS RESULTS/BEDRYFSRESULTATE

##### PRODUCTION ECONOMICS/PRODUKSIE-EKONOMIE

- PE.5621/48/1/1: Business results and the production cost of maize, sunflower and other branches of farming in the Eastern Transvaal summer rain cropping area. 1947. D.C. du Toit
- PE.5621/48/1/2: Business results and the production cost of maize, sunflower and other branches of farming in the Western Transvaal summer rain cropping areas. 1947. D.J. Mulder
- PE.5621/48/2/1: Business results and the production cost of maize, peanuts and other branches of farming in the North-western Free State summer rain cropping area. 1947. D.C. du Toit
- PE.5621/48/2/2: Business results and the production cost of wheat and other branches of farming in the Eastern Free State summer rain cropping areas. 1977. D.C. du Toit
- PE.5621/48/3/1: Business results and the production cost of wheat and other branches of farming in the Swartland of the winter rain cropping area. 1947. D.C. du Toit
- PE.5621/48/4/1: The summary and grouping of farm business results. 1980. D.C. du Toit

#### MANAGEMENT TECHNIQUES/BESTUURSTEGNIEKE

##### PRODUCTION ECONOMICS/PRODUKSIE-EKONOMIE

- PE.5622/48/1/1: Management techniques: the development of an elementary book keeping book for farmers. 1982. J.W. du Preez
- PE.5622/48/1/2: Management techniques: the development transact plan 2 of the Agrirep system. 1982. A.D.E.K. Marais
- PE.5622/48/1/3: Management techniques: research in respect of the drawing up and computerisation of income and cost budgets (Combud). 1981. W.F. Lubbe

- PE.5622/48/1/4: Management techniques: compilation of physical norms for planning purposes. 1981. W.F. Lubbe
- PE.5622/48/1/6: Management techniques: the development of a model for decision making in the replacement of orchards in the winter rain cropping areas. 1984. J.M. van Zyl
- PE.5622/48/2/1: Management techniques: farm management studies with mail-in records as data source in the Winter Rainfall Region. 1961. J.W. du Preez
- PE.5622/48/2/2: Management techniques: farm management studies with Agrirep as data source in the Winter Rainfall Region. 1981. J.W. du Preez
- PE.5622/48/3/1: Management techniques: farm management studies with mail-in records as data source in the Natal Region. 1961. E.N.C. Whitehead
- PE.5622/48/3/2: Management techniques: farm management studies with Agrirep as data source in the Natal Region. 1982. E.N.C. Whitehead
- PE.5622/48/3/3: Management techniques: farm management studies with mail-in records as data source in the Free State Region. 1961. A.D.E.K. Marais
- PE.5622/48/3/4: Management techniques: farm management studies with Agrirep as data source in the Free State Region. 1982. A.D.E.K. Marais
- PE.5622/48/4/1: Management techniques: farm management studies with mail-in records as data source in the Karoo Region. 1964. D.S. Vorster
- PE.5622/48/4/2: Management techniques: farm management studies with Agrirep as data source in the Karoo Region. 1982. D.S. Vorster
- PE.5622/48/4/3: Management techniques: farm management studies with mail-in records as data source in the Eastern Cape Region. 1964. P.F. du Plessis
- PE.5622/48/4/4: Management techniques: farm management studies with Agrirep as data source in the Eastern Cape Region. 1982. P.F. du Plessis
- PE.5622/48/5/1: Management techniques: farm management studies with mail-in records as data source in the Transvaal Region. 1964. G. Grové
- PE.5622/48/5/2: Management techniques: farm management studies with Agrirep as data source in the Transvaal Region. 1980. G. Grové
- PE.5622/48/5/3: Management techniques: farm management studies with mail-in records as data source in the Highveld Region. 1964. G. Grové
- PE.5622/48/5/4: Management techniques: farm management studies with Agrirep as data source in the Highveld Region. 1980. G. Grové
- PE.5622/48/6/1: Management techniques: the use of income and cost budgets for effective planning of livestock and crop enterprises in the Winter Rainfall Region. 1973. J.W. du Preez
- PE.5622/48/8/1: Management techniques: the use of income and cost budgets for effective planning of livestock and crop enterprises in the Karoo Region. 1973. D.S. Vorster
- PE.5622/48/8/2: Management techniques: the use of income and cost budgets for effective planning of livestock and crop enterprises in the Eastern Cape Region. 1973. P.F. du Plessis
- PE.5622/48/7/1: Management techniques: the use of income and cost budgets for effective planning of livestock and crop enterprises in the Natal Region. 1973. E.N.C. Whitehead
- PE.5622/48/7/2: Management techniques: the use of income and cost budgets for effective planning of livestock and crop enterprises in the Free State Region. 1973. A.D.E.K. Marais
- PE.5622/48/7/3: Management techniques: preparation and updating of machinery cost standards. 1980. E.N.C. Whitehead



- PE.5622/48/9/1: Management techniques: the use of income and cost budgets for effective planning of livestock and crop enterprises in the Transvaal Region. 1973. W.F. Lubbe
- PE.5622/48/9/2: Management techniques: the use of income and cost budgets for effective planning of livestock and crop enterprises in the summer rain cropping area of the Highveld Region. 1973. W.F. Lubbe

## ENTERPRISE RELATIONSHIPS/BEDRYFSVERHOUDINGS

### PRODUCTION ECONOMICS/PRODUKSIE-EKONOMIE

- PE.5623/48/1/1: Enterprise relationship: research in respect of alternative farming systems in the Swartland in the winter rain cropping area. 1981
- PE.5623/48/1/2: Enterprise relationship: economical research in respect of the control of false codling moth on citrus in the winter rain cropping area. 1981
- PE.5623/48/1/3: Enterprise relationship: research in respect of the difficulties in labour utilisation in Oriental tobacco production of the Western Cape in the winter rain cropping areas. 1981
- PE.5623/48/1/4: Enterprise relationship: the determination of alternative farming systems for the South-western Cape in the winter rain cropping areas. 1984. B.L. Coetsee
- PE.5623/48/2/2: Enterprise relationship: the introduction of long-term pasture crops in sheep production systems in the central grassveld of the Free State Region. 1982. S.J.L. Marais
- PE.5623/48/2/3: Enterprise relationship: an economic evaluation of some crop rotation systems under dryland conditions in the central Free State. 1983. J.A. Grobbelaar
- PE.5623/48/3/1: Enterprise relationship: the economic evaluation of the utilisation of fodder crops with Merino sheep in the Fish River Valley. 1982. J. Jamneck
- PE.5623/48/3/2: Enterprise relationship: the economic evaluation of development studies of components of dry grass-bushveld grazing in the Eastern Cape. 1976. P.F. du Plessis
- PE.5623/48/3/3: Enterprise relationship: the economic evaluation of the potential of pastures in respect of small stock in the eastern coastal areas of the Eastern Cape. 1976. P.F. du Plessis
- PE.5623/48/3/4: Enterprise relationship: the development and evaluation of a profitable livestock farming system for the valley bushveld areas in good condition in the Eastern Cape Region. 1983. P.F. du Plessis
- PE.5623/48/3/5: Enterprise relationship: the development and evaluation of a profitable livestock farming system for the valley bushveld in deteriorated condition of the Eastern Cape Region. 1983. P.F. du Plessis
- PE.5623/48/3/6: Enterprise relationship: the development, management and evaluation of adapted livestock farming system Campagna in the high rainfall sourveld areas of the Eastern Cape. 1983. P.F. du Plessis
- PE.5623/48/4/1: Enterprise relationship: wintering of woolled sheep and other livestock in the northern Drakensberg grazing region. 1982. G. Grové
- PE.5623/48/4/2: Enterprise relationship: profitability analysis of selected perennial crops in the Transvaal Region. 1982. W.F. Lubbe
- PE.5623/48/4/3: Enterprise relationship: the influence of different feeding strategies on the economic efficiency of beef cattle in the summer rain cropping areas. 1983. J. Hough
- PE.5623/48/4/4: Enterprise relationship: research in respect of the economic advantages of conservation tillage in the summer rain cropping area of Western Transvaal and North-western Free State. 1983. J. Hough

- PE.5623/48/4/5: An economic analysis of dairy enterprises and their financial roles in the farming structure of mixed farming in the summer rain cropping area. 1984. P.J. Cornelius
- PE.5623/48/4/6: Enterprise relationship: a comparison of margins among weaner, tollie and ox production systems in the bushveld of Northern Transvaal. 1984. D.C. du Toit
- PE.5623/48/4/7: Enterprise relationship: strategy for production continuation and renewal of citrus and subtropical orchards in the bushveld area. 1984. D.C. du Toit
- PE.5623/48/4/8: Enterprise relationship: an economic evaluation of milk and beef production of Simmentalers on natural veld and dryland - *Cenchrus* pasture on the Springbok Flats of Transvaal. 1984. D.C. du Toit

## SOIL CONSERVATION RESEARCH/GRONDBEWARINGSNAVORSING

### Soil conservation/Grondbewaring

#### EROSION/EROSIE

##### CONSERVATION STUDIES/BEWARINGSTUDIES

- D.5711/38/1/1: Erosion: the determination of soil losses associated with various tillage practices on various soil series established to pineapples in the East Lodon district. 1982. C.J. Bradfield
- D.5711/38/1/2: Erosion: the determination of soil losses associated with various tillage practices and land use on soil series at Alexandria. 1983. P.C. Griffiths
- D.5711/38/2/1: Erosion: the effect of small structures in eroded watercourses in the high rainfall sourveld. 1983. B.I. Hill
- N.5711/38/1/1: Erosion studies using natural run-off plots. 1985. R.P. Simms
- N.5711/38/1/2: Studies using a rainfall simulator and natural run-off plots to quantify soil losses from veld. 1982. R.P. Simms

##### ENGINEERING/INGENIEURSWESE

- LI.5711/51/1/1: Engineering aspects of soil erosion: aspects of gully erosion. 1983. A.H. McNaughton
- LI.5711/51/1/2: Engineering aspects of soil erosion: aspects regarding soil losses. 1983. P. McPhee

## RESOURCE CONSERVATION/HULPBRONBEWARING

### Planning of areas/Beplanning van gebiede

#### FARM PLANNING/PLAASBEPLANNING

##### AGROHYDROLOGY/AGROHIDROLOGIE

- N.5831/34/1/1: Farm planning: run-off control planning in Howick Extension Ward. 1979. M.G. Price
- N.5831/34/1/2: Farm planning: run-off control planning in Greytown Extension Ward. 1979. R.C. Richardson
- N.5831/34/1/3: Farm planning: run-off control planning in the Ixopo Extension Ward. 1979. A.D. Simpson
- N.5831/34/1/4: Farm planning: run-off control planning in the Pongola Extension Ward. 1979. A.D. Robinson

- N.5831/34/1/5: Farm planning: run-off control planning in the Kokstad Extension Ward. 1979.  
D.B. Austin
- N.5831/34/1/6: Farm planning: run-off control planning in the Richmond Extension Ward. 1979.  
E.M.F. McAllister
- N.5831/34/1/7: Farm planning: run-off control planning in Newcastle Extension Ward. 1979.  
M.P. Wentzel
- N.5831/34/1/8: Farm planning: run-off control planning in the Vryheid Extension Ward. 1979.  
R.J. Dicks
- N.5831/34/1/9: Farm planning: run-off control planning in the Estcourt Extension Ward. 1979.  
S.K. Armour
- N.5831/34/1/10: Farm planning: run-off control planning in the Dundee Extension Ward. 1979.  
P.P. Kloppers
- N.5831/34/1/11: Farm planning: run-off control planning in the Pietermaritzburg Extension Ward.  
1979. P.J.D. Nicholson
- N.5831/34/1/12: Farm planning: run-off control planning in the Ladysmith Extension Ward. 1979.  
K.W. Watkinson

#### MANAGEMENT/BESTUUR

- D.5831/41/1/1: Planning of farms within the Alexandria magisterial district to promote the  
efficient conservation of natural resources. 1984. P.C. Griffiths
- D.5831/41/2/1: Run-off control planning of farms in the sub-catchment area No. 10900104 in the  
Humansdorp Extension Ward. 1984. J.P. van Zyl
- D.5831/41/2/2: Run-off control planning of farms in the Zuney Valley, sub-catchment area No.  
14200200. 1984. P.C. Griffiths



## **ENTREPRENEUR DEVELOPMENT/ONDERNEMERS- ONTWIKKELING**

### **EXTENSION SCIENCE INVESTIGATIONS/VOORLIGTINGKUNDIGE ONDERSOEKE**

#### **Resources and technology/Hulpbronne en tegnologie**

##### **MAN/MENS**

##### **SITUATION ANALYSIS/SITUASIEBEPALING**

- H.6115/35/1/1: Factors that influence the under-achievement of first-year students at Potchefstroom College of Agriculture. 1983. L.I. de Waal

##### **PERSUASION/OORREDING**

- K.6115/39/1/1: Man: persuasion of putative trespassers of the Agricultural Resources Act in the Cradock Extension Ward. 1985. P.S. van Heerden
- K.6115/39/1/2: Man: persuasion of putative trespassers of the Agricultural Resources Act in the Graaff Reinet Extension Ward. 1985. J.G. Theron
- K.6115/39/1/3: Man: persuasion of putative trespassers of the Agricultural Resources Act in the Middelburg Extension Ward. 1985. J.D. Blom

##### **EXTENSION SCIENCE/VOORLIGTINGKUNDE**

- D.6115/40/1/1: Man: the role of opinion leaders in the diffusion of innovations in the Stutterheim Extension Ward. 1983. P.G. King
- H.6115/40/1/1: Man: the adoption pattern of stubble mulch practices by maize farmers in the Bothaville Extension Ward. 1985. G.P. van Wyk
- H.6115/40/2/1: The role of needs and the group dynamic processes in group participation in the Lichtenburg subregion. 1985. M.M. Grobbelaar
- N.6115/40/1/1: Human potential in relation to optimum land use of farmers in the Underberg Extension Ward. 1974. D.M. Rix

##### **COMMUNICATION/KOMMUNIKASIE**

##### **EXTENSION SCIENCE/VOORLIGTINGKUNDE**

- N.6119/40/1/1: The use of agricultural literature in communicating information to farmers in the Natal Region. 1982. Marion A. Abbott

## **PROGRAMMED EXTENSION/GEPROGRAMMEERDE VOORLIGTING**

#### **Resource utilisation/Hulpbronbenutting**

##### **STOCK AND GAME FARMING/VEE- EN WILDBOERDERY**

##### **PERSUASION/OORREDING**

- D.6211/39/1/1: Stock and game farming: persuasion of farmers to establish cultivated pastures in the Elands River area of the Uitenhage Extension Ward. 1979. L.O. Grobler

# Registered projects/Geregistreeerde projekte

- D.6211/39/2/1: Stock and game farming: promotion of adapted stock farming in the Valley Bushveld of the Uitenhage Extension Ward. 1984. L.O. Grobler
- K.6211/39/1/1: Stock and game farming: persuasion of farmers to apply the group camp approach of veld management in the Extension Ward of Graaff Reinet. 1985. J.G. Theron
- K.6211/39/1/2: Stock and game farming: persuasion of farmers to apply the group camp approach of veld management in the Cradock Extension. 1985. P.S. van Heerden
- K.6211/39/1/3: Stock and game farming: persuasion of farmers to practise the group camp approach of veld management in the Burgersdorp Extension Ward. 1985. W. v.D. Botha
- K.6211/39/1/4: Stock and game farming: persuasion of farmers to practise the group camp approach of veld management in the Colesberg Extension Ward. 1985. M. van Niekerk
- K.6211/39/1/5: Stock and game farming: persuasion of farmers to practise the group camp approach of veld management in the De Aar Extension Ward. 1985. W.H. van Staden
- K.6211/39/1/6: Stock and game farming: persuasion of farmers to practise the group camp approach of veld management in the Middelburg Extension Ward. 1985. J.D. Blom
- K.6211/39/1/7: Stock and game farming: persuasion of farmers to practise the group camp approach of veld management in the Calvinia Extension Ward. 1985. N. Nortje
- K.6211/39/1/8: Stock and game farming: persuasion of farmers to practise the group camp approach of veld management in the Carnarvon Extension Ward. 1985. G.Z.J. Barnard
- K.6211/39/1/9: Stock and game farming: persuasion of farmers to practise the group camp approach of veld management in the Kenhardt Extension Ward. 1985. J.J. Zandberg
- K.6211/39/1/10: Stock and game farming: persuasion of farmers to practise the group camp approach of veld management in the Prieska Extension Ward. 1985. D.J. Roux
- K.6211/39/2/1: Stock and game farming: persuasion of farmers to introduce drought fodder crops in the farming systems in the Graaff Reinet Extension Ward. 1984. J.G. Theron
- K.6211/39/2/2: Stock and game farming: persuasion of farmers to establish drought fodder crops in the Colesberg Extension Ward. 1985. M. van Niekerk
- K.6211/39/2/3: Stock and game farming: persuasion of farmers to establish drought fodder crops in the De Aar Extension Ward. 1985. W.H. van Staden
- K.6211/39/2/4: Stock and game farming: persuasion of farmers to establish drought fodder crops in the Middelburg Extension Ward. 1985. J.D. Blom
- K.6211/39/2/5: Stock and game farming: persuasion of farmers to introduce drought fodder crops in the farming systems in the Calvinia Extension Ward. 1985. N. Nortje
- K.6211/39/2/6: Stock and game farming: persuasion of farmers to introduce drought fodder crops in the farming systems in the Carnarvon Extension Ward. 1985. G.Z.J. Barnard
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- K.6211/39/2/8: Stock and game farming: persuasion of farmers to introduce drought fodder crops in the farming systems in the Prieska Extension Ward. 1985. D.J. Roux
- K.6211/39/3/1: Stock and game farming: promotion of the combating of proclaimed weeds in the veld in the Somerset East Extension Ward. 1985. J.C. van Aardt
- K.6211/39/3/2: Stock and game farming: promotion of the combating of proclaimed weeds in the Graaff Reinet Extension Ward. 1980. J.G. Theron
- N.6211/39/1/1: Stock and game farming: the promotion of cultivated pastures in the Dundee Extension Ward. 1984. B.N. Genlloud
- N.6211/39/1/2: Stock and game farming: the promotion of cultivated pastures in the Howick Extension Ward. 1981. R.N. Webster
- N.6211/39/1/3: Stock and game farming: the promotion of cultivated pastures in the Ixopo Extension Ward. 1985. M.J. Pereira da Conceico

- N.6211/39/1/4: Stock and game farming: the promotion of cultivated pastures in the Kokstad Extension Ward. 1985. G.P. Devereux
- N.6211/39/1/5: Stock and game farming: the promotion of cultivated pastures in the Underberg Extension Ward. 1985. C.M. Allan
- N.6211/39/2/1: Stock and game farming: the promotion of improved veld management practices in the Weenen Conservation District.
- N.6211/39/2/2: Stock and game farming: the promotion of improved veld management practices in the Muden area of the Umvoti magisterial district. 1979. K.G. Camp
- N.6211/39/3/1: Stock and game farming: the persuasion of farmers to control *Rubus cuneifolius* in the Howick Extension Ward. 1981. R.M. Webster
- N.6211/39/4/1: Stock and game farming: the promotion of dairy farming in the Ixopo Extension Ward. 1985. M.J. Pereira da Conceico

#### MODELLING/MODELLERING

- N.6211/42/1/1: Stock and game farming: development of a beef feeding simulator programme. 1975. B.J. Lyle
- N.6211/42/1/2: Stock and game farming: development of a dairy herd computer simulator programme. 1975. P.G. Stewart
- N.6211/42/1/3: Stock and game farming: development of a beef breeding herd simulator programme. 1975. B.J. Lyle
- N.6211/42/1/5: Stock and game farming: fodder production planning for farming units. 1976. R.I. Jones
- N.6211/42/1/6: Stock and game farming: development of micro-computer programmes for dairy herd management. 1981. R.I. Jones

#### CROP FARMING/SAAIBOERDERY

##### PERSUASION/OORREDING

- K.6212/39/1/1: Crop farming: promotion of durum wheat cultivation in the Fish River Valley in the Cradock Extension Ward. 1980. P.S. van Heerden
- K.6212/39/2/1: Crop farming: persuasion of farmers to practise optimal irrigation management and techniques in the Cradock Extension Ward. 1984. P.S. van Heerden
- K.6212/39/2/2: Crop farming: persuasion of farmers to practise optimal irrigation management and techniques in the Somerset East Extension Ward. 1984. P.S. van Heerden
- N.6212/39/1/1: The promotion of improved crop farming practices in the Winterton Conservation Area. 1976. S.D. le Roux

#### MIXED FARMING/GEMENGDE BOERDERY

##### PERSUASION/OORREDING

- H.6213/39/1/1: Persuasion of farmers with mixed farming enterprises in the Bethlehem Extension Ward in order to promote optimal land utilisation. 1981. G.B. Steyl
- H.6213/39/1/2: Persuasion of farmers with mixed farming enterprises in the Harrismith Extension Ward in order to promote optimal land utilisation. 1983. G.B. Steyl
- H.6213/39/1/3: Persuasion of farmers with mixed farming enterprises in the Kroonstad Extension Ward in order to promote optimal land utilisation. 1981. J.N. Mans
- H.6213/39/1/4: Persuasion of farmers with mixed farming enterprises in the Bothaville Extension Ward in order to promote optimal land utilisation. 1979. J.N. Mans



- H.6213/39/1/5: Persuasion of farmers with mixed farming enterprises in the Parys Extension Ward in order to promote optimal land utilisation. 1981. P.W.B. Joubert
- H.6213/39/1/6: Persuasion of farmers with mixed farming enterprises in the Klerksdorp Extension Ward in order to promote optimal land utilisation. 1981. P.W.B. Joubert
- H.6213/39/1/7: Persuasion of farmers with mixed farming enterprises in the Lichtenburg subregion in order to promote optimal land utilisation. 1982. A.H. Meyer
- H.6213/39/1/8: Persuasion of farmers with mixed farming enterprises in the Heidelberg subregion in order to promote optimal land utilisation. 1978. J.C. Louw
- T.6213/39/1/1: Mixed farming: the persuasion of farmers to practise optimal resource utilisation in the high rainfall sourveld area of Belfast. 1985. A. van Deventer

#### **FRUIT FARMING/VRUGTEBOERDERY**

##### **SITUATION ANALYSIS/SITUASIEBEPALING**

- N.6214/35/1/1: Situation analysis: bananas in the Port Shepstone Extension Ward. 1983. E.H. Gevers

#### **AGRICULTURAL ENGINEERING SERVICES/LANDBOU- INGENIEURSDIENSTE**

##### **Agricultural mechanisation/Landboumeganisasie**

##### **POWER SOURCES AND LABOUR/KRAGBRONNE EN ARBEID**

##### **ENGINEERING/INGENIEURSKUNDE**

- LI.61/111/51/1/1: Evaluation of tractor characteristics - power take-off shaft and safety frames. 1982. R.S. Allan
- LI.61/111/51/1/2: Power sources and labour: performance of two-wheel, four-wheel and crawler track-driven tractors under a variety of conditions. 1981. J.H. Grobler
- LI.61/111/51/1/3: Power sources and labour: performance of tractor three-point hitch systems. 1981. A.J. Heyns

##### **AGRICULTURAL IMPLEMENTS/LANDBOUWERKTUIG**

##### **ENGINEERING/INGENIEURSKUNDE**

- LI.61/112/51/1/1: Engineering aspects of agricultural machinery. 1982. A.J. Heyns

##### **Agricultural structures and facilities/Landboustrukture en -fasiliteite**

##### **CLIMATE-CONTROLLED STRUCTURES/KLIMAATBEHEERDE STRUKTURE**

##### **ENGINEERING/INGENIEURSKUNDE**

- LI.61/122/51/1/1: Engineering aspects of climatic-controlled structures. 1982. P.J. Britz

##### **STOCK HOUSING AND FACILITIES/VEEBEHUISING EN -FASILITEITE**

##### **ENGINEERING/INGENIEURSKUNDE**

- LI.61/123/51/1/1: Engineering aspects of animal housing and facilities. 1982. P.A. Henning
- LI.61/123/51/1/2: Engineering aspects of animal housing and related facilities in the Winter Rainfall Region. 1982. J.C. Venter

**Irrigation and drainage engineering/Besproeiings- en dreineringsingenieurswese**

**IRRIGATION/BESPROEIING**

**ENGINEERING/INGENIEURSKUNDE**

LI.61/31/51/1/1: Engineering aspects of irrigation. 1982. A.T. van Coller

**DRAINAGE/DREINERING**

**ENGINEERING/INGENIEURSKUNDE**

LI.61/32/51/1/1: Engineering aspects of sub-surface drainage systems. 1982. F.B. Reinders

## BOTANY/BOTANIE

### BOTANY RESEARCH/BOTANIESE NAVORSING

#### Plant taxa/Planttaksons

##### FLORA

##### TAXONOMY/TAKSONOMIE

- PL.7111/01/1/4: Flora of southern Africa: Xyridaceae, Eriocaulaceae, Commelinaceae, Potederiaceae and Juncaceae. 1978. A.A. Mauve
- PL.7111/01/1/6: Flora of southern Africa: Liliaceae - Dracaenoideae and Asparagoideae. 1979. A.A. Mauve
- PL.7111/01/1/7: Flora of southern Africa: Ericaceae - minor genera. 1970. E.G.H. Oliver
- PL.7111/01/1/9: Flora of southern Africa: Lamiaceae. 1973. G.E. Gibbs-Russell
- PL.7111/01/1/11: Flora of southern Africa: Mesembryanthemaceae - Ruschiinae. 1977. H.F. Glen
- PL.7111/01/1/13: Flora of southern Africa: Sterculiaceae - Hermannia section. 1968. B. de Winter
- PL.7111/01/1/14: Flora of southern Africa: Bryophyta. 1976. J. van Rooy
- PL.7111/01/1/16: Flora of southern Africa: botanical collectors. 1969. G.E. Gibbs-Russell
- PL.7111/01/1/17: Flora of southern Africa: keys to southern African grasses. 1981. G.E. Gibbs-Russell
- PL.7111/01/1/18: Flora of southern Africa: Poaceae subfamilies Oryzoideae, Centostecoideae and Bambusoideae. 1981. G.E. Gibbs-Russell
- PL.7111/01/1/19: Flora of southern Africa: Restionaceae. 1981. H.P. Linder
- PL.7111/01/1/20: Flora of southern Africa: the tribe Desmodieae (Fabaceae - Papillonoideae). 1981. B.D. Schrire
- PL.7111/01/1/21: Flora of southern Africa: Orchidaceae. 1981. O.A. Leistner
- PL.7111/01/1/23: Flora of southern Africa: Salicaceae, Fabaceae, Urticaceae and Piperaceae. 1984. K.L. Immelman
- PL.7111/01/1/24: Flora of southern Africa: the tribe Tephrosieae (Fabaceae - Papillonoideae). 1985. B.D. Schrire
- PL.7111/01/1/25: Flora of southern Africa: the genus *Rhus* (Anacardiaceae). 1985. R.O. Moffett
- PL.7111/01/2/1: Illustrated flora of the Pretoria Region. 1973. O.A. Leistner
- PL.7111/01/2/2: Regional flora: Transvaal wild flowers (Vol. 2). 1984. G. Germishuizen

##### ANGIOSPERMAE

##### TAXONOMY/TAKSONOMIE

- PL.7112/01/1/1: Taxonomy of Angiospermae: the family Polygonaceae. 1979. G. Germishuizen
- PL.7112/01/1/3: Taxonomy of Angiospermae: the genus *Ficinia* (section Bracteosae). 1976. T.H. Arnold
- PL.7112/01/1/5: Taxonomy of Angiospermae: the genus *Justicia* in southern Africa. 1982. K.L. Immelman
- PL.7112/01/1/6: Taxonomy of Angiospermae: the role of fruit, seed and seedling characters in the classification of Cucurbitaceae in southern Africa. 1983. E. Retief
- PL.7112/01/1/7: Taxonomy of Angiospermae: the genus *Vigna* Savi in southern Africa. 1984. B.J. Pienaar



- PL.7112/01/1/8: Taxonomy of Angiospermae: the genus *Carex* L. in southern Africa. 1985. C. Reid  
 PL.7112/01/2/1: Biosystematics of Angiospermae: the *Eragrostis curvula* complex. 1972. B. de Winter  
 PL.7112/01/3/1: Angiospermae: flowering plants of Africa. 1921. D.J.B. Killick

#### ANATOMY/ANATOMIE

- PL.7112/02/1/1: Comparative anatomy of the angiosperm subfamily Arundinoideae. 1972. R.P. Ellis  
 PL.7112/02/1/2: Comparative anatomy of the angiosperm subfamily Bambusoideae. 1972. R.P. Ellis  
 PL.7112/02/1/3: Comparative anatomy of the angiosperm subfamily Festucoideae. 1972. R.P. Ellis  
 PL.7112/02/1/4: Comparative anatomy of the angiosperm subfamily Panicoideae. 1972. R.P. Ellis  
 PL.7112/02/1/5: Comparative anatomy of the angiosperm subfamily Eragrostoideae. 1972. R.P. Ellis  
 PL.7112/02/1/7: Grass identification by epidermal structure for herbivore food studies in the Angiospermae. 1979. R.P. Ellis  
 PL.7112/02/2/1: Morphological and anatomical survey of the wood and bark of southern African woody Angiospermae. 1984. P.P.J. Herman  
 PL.7112/02/2/2: The application of wood anatomical information of the southern African woody Angiospermae to dendrochronology, wood technology, tree physiology and forensic science. 1984. P.P.J. Herman

#### GENETICS/GENETIKA

- PL.7112/06/1/1: Cytotaxonomic studies of Angiospermae: the genus *Sorghum*. 1983. J.J. Spies  
 PL.7112/06/1/2: Cytotaxonomic studies of Angiospermae: the creation of a cytodatabank, 1982. J.J. Spies  
 PL.7112/06/2/1: Karyotype studies of the Angiosperm family Poaceae: the subfamily Arundinoideae. 1983. J.J. Spies  
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 PL.7112/06/2/3: Karyotype studies of the Angiosperm family Poaceae: the subfamily Festucoideae. 1983. J.J. Spies  
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#### PLANT GEOGRAPHY/PLANTGEOGRAFIE

- PL.7112/25/1/3: Final distribution atlas of the woody Angiospermae of the Transvaal. 1979. J.M. Anderson

#### BRYOPHYTA

#### TAXONOMY/TAKSONOMIE

- PL.7115/01/1/1: Bryophyta: the ultrastructure of the wall ornamentation as a taxonomic aid in identifying the species of the genus *Riccia* (Hepaticae) in southern Africa. 1981. S.M. Perold

#### FOSSIL PLANTS/FOSSIELPLANTE

#### TAXONOMY/TAKSONOMIE

- PL.7118/01/1/1: The fossil plants of the Upper Triassic Molteno Formation in South Africa. 1978. J.M. Anderson

## Vegetation/Plantegroei

### FOREST/WOUD

#### ECOLOGY/EKOLOGIE

- PL.7121/27/1/1: Vegetation study of the Zululand coastal dunes, including forest, between Richards Bay and Mlalazi Lagoon. 1980. P.J. Weisser
- PL.7121/27/1/2: Coast forest biome: conservation priorities in the dune area between Kosi Bay and Sodwana based on a vegetation survey. 1985. P.J. Weisser
- PL.7121/27/2/1: A regional plant-ecological study of forests, woodlands and grasslands of the north-eastern mountain sourveld (and adjacent lowveld sour bushveld) in the Sabie area of the Eastern Transvaal escarpment. 1982. G.B. Deall

### BUSHVELD/BOSVELD

#### ECOLOGY/EKOLOGIE

- PL.7122/27/1/1: Seasonal growth of woody bushveld plants in the Nylsvley *Burkea* Savanna Ecosystem Project. 1975. M.C. Rutherford
- PL.7122/27/2/1: The plant ecology of the bushveld farm Groothoek, Thabazimbi district. 1980. R.H. Westfall
- PL.7122/27/2/2: The vegetation ecology of sour bushveld in the Transvaal Waterberg. 1984. R.H. Westfall

### FYNBOS

#### ECOLOGY/EKOLOGIE

- PL.7123/27/1/1: Vegetation transects through the Western Cape lowland fynbos. 1977. C. Boucher
- PL.7123/27/1/2: A semi-detailed regional ecological study of the Western Cape lowland fynbos. 1970. C. Boucher
- PL.7123/27/1/3: A plant-ecological study of the fynbos and other vegetation in the southern Cape coastal foreland. 1985. C. Boucher
- PL.7123/27/2/1: A plant-ecological study of the Cape Point Nature Reserve. 1965. H.C. Taylor
- PL.7123/27/2/2: A structural-functional classification of mountain fynbos. 1978. J.C. Scheepers
- PL.7123/27/2/3: The fynbos communities of Swartboschkloof, Jonkershoek. 1982. D.J. Macdonald
- PL.7123/27/2/4: A plant-ecological study of the fynbos and other vegetation in mountain catchments of the Langeberg, South-western Cape. 1984. D.J. Macdonald
- PL.7123/27/2/5: An ecological study of mountain fynbos in the Cedarberg. 1984. H.C. Taylor
- PL.7123/27/3/1: An ecophysiological study of fynbos seedling development under competitive stress with invasive alien acacias. 1982. F.M. Pressinger
- PL.7123/27/3/2: Relative productive capacities of species populations following fire in indigenous alien mixed plant communities in the fynbos biome. 1984. C.F. Musil
- PL.7123/27/3/3: Survival of fynbos plants in areas severely invaded by alien plant species. 1984. M.C. Rutherford

### GRASSLAND/GRASVELD

#### ECOLOGY/EKOLOGIE

- PL.7124/27/1/1: A plant-ecological study of the grassland and other vegetation in the Amersfoort area of Eastern Transvaal highveld. 1984. B.J. Turner

- PL.7124/27/1/2: A plant-ecological study of the grassland and other vegetation in the Grootvlei area of the Highveld Region. 1984. C.W. Ries

KAROO

ECOLOGY/EKOLOGIE

- PL.7125/27/1/1: Water-use efficiencies of the main plant life forms in the western Karoo. 1984. M.C. Rutherford

AQUATIC VEGETATION/AKWATIESE PLANTEGROEI

ECOLOGY/EKOLOGIE

- PL.7126/27/1/1: Aquatic macrophyte vegetation of Natal. 1974. C.F. Musil  
PL.7126/27/1/2: Study of the aquatic vegetation of the Cape estuaries from the Kei River to the Orange River. 1981. M.G. O'Gallaghan

NATURALISED VEGETATION/NATUURLIKE PLANTEGROEI

GENETICS/GENETIKA

- PL.7127/06/1/1: Naturalised vegetation: a cytotaxonomic study of *Lantana camara* in southern Africa. 1979. J.J. Spies  
PL.7127/06/1/2: Naturalised vegetation: cytotaxonomy of *Rubus* in South Africa. 1975. J.J. Spies

PLANT GEOGRAPHY/PLANTGEOGRAFIE

- PL.7127/25/1/1: Naturalised vegetation: woody plant invaders of the Transvaal. 1979. M.J. Wells

ECOLOGY/EKOLOGIE

- PL.7127/27/1/1: Naturalised vegetation: field and laboratory growth of *Eichhornia crassipes* in relation to nitrogen and phosphorus loading. 1974. C.F. Musil  
PL.7127/27/1/2: Naturalised vegetation: review of knowledge of nassella tussock grass. 1972. M.J. Wells

EVALUATION/EVALUASIE

- PL.7127/37/1/1: Naturalised vegetation: compilation and maintenance of a national weed list. 1979. M.J. Wells

AFRICAN VEGETATION/AFRIKAANSE PLANTEGROEI

ECOLOGY/EKOLOGIE

- PL.7128/27/1/1: African vegetation: a plant-ecological bibliography for southern Africa up to 1975. 1972. A. P. Backer  
PL.7128/27/1/2: African vegetation: a plant-ecological bibliography for southern Africa from 1976 to 1980. 1976. A.P. Backer  
PL.7128/27/2/1: African vegetation: a revision of the Karoid and adjoining veld types. 1945. J.C. Scheepers  
PL.7128/27/2/2: African vegetation: an objective categorisation of the biomes of southern Africa. 1984. M.C. Rutherford  
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## Registered projects/Geregistreerde projekte

- PL.7128/27/4/1: The computerisation of African vegetation and habitat data for the national resource inventory using PRECIS, National Herbarium, Pretoria for taxon updates. 1985. B.J. Vermeulen
- PL.7128/27/4/2: A photo-data base for visual analyses of spatial and temporal change in African vegetation types. 1985. A.P. Backer

## Valuable veld plants/Waardevolle veldplante

### FOOD PLANTS/VOEDSELPLANTE

#### TAXONOMY/TAKSONOMIE

- PL.7131/01/1/1: A preliminary investigation of the taxonomy and economic importance of food plants of African origin. 1979. T.H. Arnold

#### POTENTIAL STUDIES/POTENSIAALSTUDIES

- PL.7131/36/1/1: The evaluation of selected Cucurbitaceae and Leguminosae taxa as potential food plants for future economic exploitation. 1979. S.E. Chadwick

### ORNAMENTAL PLANTS/SIERPLANTE

#### ECOLOGY/EKOLOGIE

- PL.7134/27/1/1: The effect of substrate disturbance on fynbos systems as a result of marginal cultivation of fynbos ornamental plants. 1984. G.W. Davis
- PL.7134/27/1/2: Computer simulation of the activities of wild flower pickers in relation to available resources and market demands to predict pressure on natural populations of fynbos ornamental plant species. 1975. G.W. Davis

### COVER AND BARRIER PLANTS/DEK- EN VERSPERRINGSPLANTE

#### POTENTIAL STUDIES/POTENSIAALSTUDIES

- PL.7135/36/1/1: Survey of potential cover and barrier plants. 1979. L. Henderson

### OTHER USEFUL PLANTS/ANDER NUTTIGE PLANTE

#### ETHNOBOTANY/ETNOBOTANIE

- PL.7136/26/1/1: Other useful plants: tribal plant uses in South Africa. 1977. M.J. Wells
- PL.7136/26/2/1: Other useful plants: Iron and Stone Age ethnobotany of Border Cave, Lebombo Mountain. 1976. M.J. Anderson

## Research collections/Navorsingsversamelings

### NATIONAL HERBARIUM/NASIONALE HERBARIUM

#### TAXONOMY/TAKSONOMIE

- PL.7141/01/1/1: Development of a special vehicle, apparatus and labour-saving devices and methods for plant collecting for the National Herbarium, Pretoria. 1984. M.D. Panagos

# Registered projects/Geregistreeerde projekte

- PL.7141/01/1/2: Collecting Poaceae for the National Herbarium, Pretoria. 1983. L. Smook
- PL.7141/01/1/3: Expansion of the taxonomic research collections of the National Herbarium, Pretoria: the development of the fruit and seed collection. 1983. E. Retief
- PL.7141/01/1/4: Determination of priority collecting areas and the creation of a general collecting programme for the National Herbarium, Pretoria. 1984. L. Smook



**SUPPORTING AND ASSOCIATED SERVICES/ONDER-  
STEUNENDE EN VERWANTE DIENSTE**

**BIOMETRIC AND DATAMETRIC SERVICES/BIOMETRIESE  
EN DATAMETRIESE DIENSTE**

**Biometric services/Biometriese dienste**

**ANALYTIC TECHNIQUES/ONTLEDINGSTEGNIEKE**

**BIOMETRY/BIOMETRIE**

BM.1/212/43/1/1: Biometric analysis techniques as applied to data derived from soil analyses in Transvaal and Natal. 1983. B.E. Eisenberg



